Electrical World

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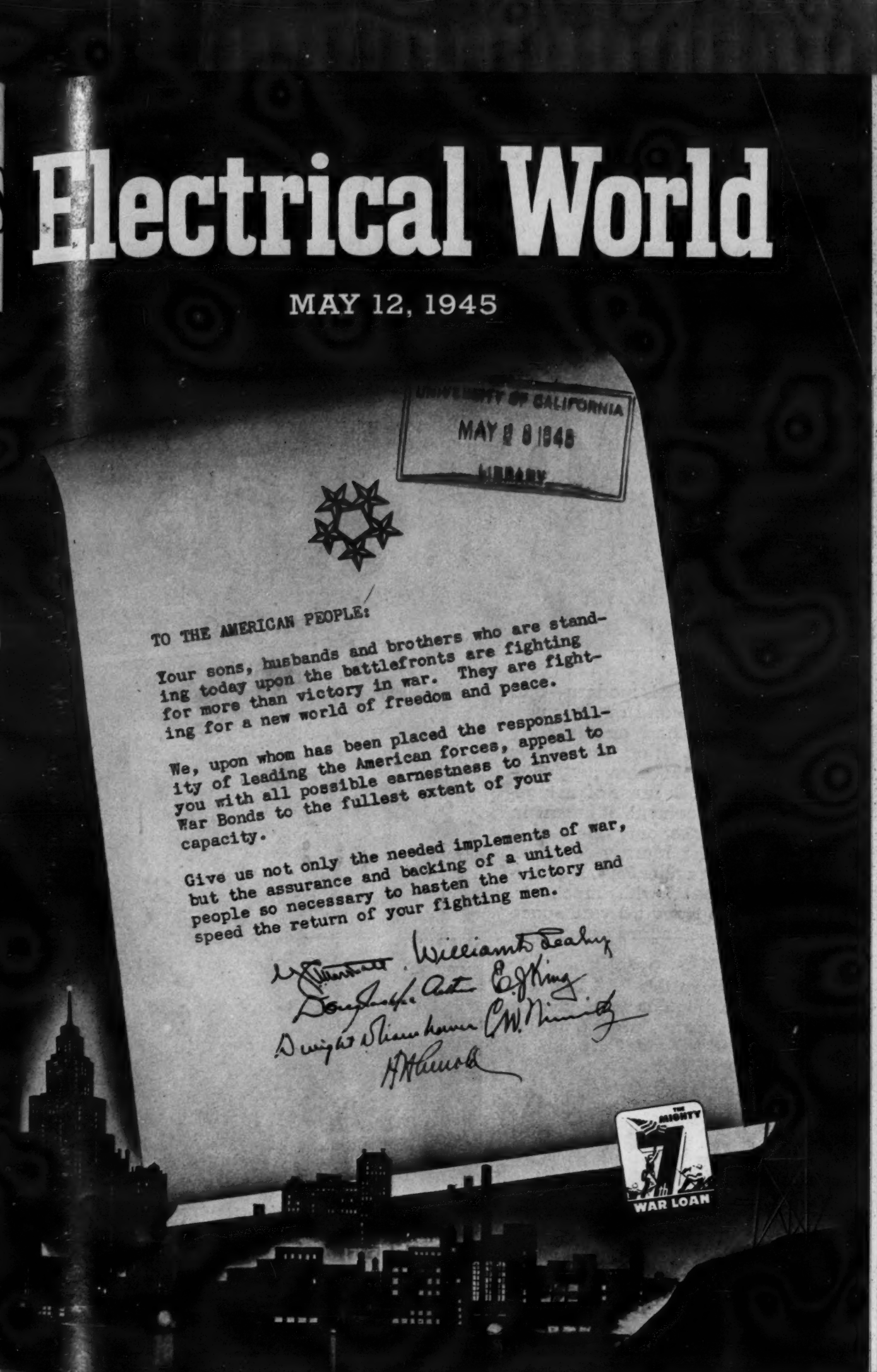
TO THE AMERICAN PEOPLE:
Your sons, husbands and brothers who are standing today upon the battlefronts are fighting for more than victory in war. They are fighting for a new world of freedom and peace.
We, upon whom has been placed the responsibility of leading the American forces, appeal to you with all possible earnestness to invest in War Bonds to the fullest extent of your capacity.
Give us not only the needed implements of war, but the assurance and backing of a united people so necessary to hasten the victory and speed the return of your fighting men.
THE MIGHTY 7th WAR LOAN

Sturdy reliable new—

THE Murray

"A" Box—modernized

THIS "A" Box is modern—and for indoor and outdoor use. It is rugged and emphatically time-resistant. It accommodates modern, bottom-connected, watt-hour meters. Because of an ingenious arrangement, inherent in the tough case, only one seal is needed. The Murray "A" Box (catalog is number 9600) is generously supplied with knockouts. It occupies standard wall space and has standard mounting holes.

We believe this "A" Box will prove as popular with you as with its many, many users. Metropolitan Device Corporation, Brooklyn 16, N. Y.

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Device Corporation
1250 Atlantic Avenue
Brooklyn 16, New York

Send me informative printed matter on unique Murray "A" Box —no obligation

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Electrical World

PUBLISHED IN THIRTY-FIRST YEAR OF ELECTRICAL AGE FOR 91 YEARS

May 12, 1945 — Vol. 123, No. 19

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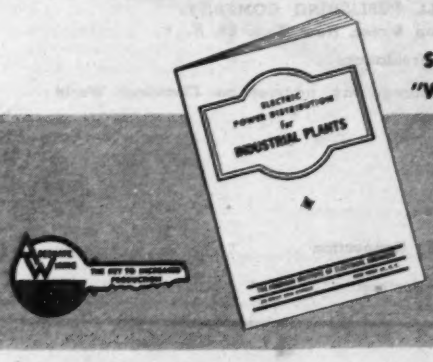
The right plans today can prevent electrical "growing pains" tomorrow. Adequate wiring today can make old or new buildings ready for load upswings tomorrow. Seldom before has the selection of a power distribution system been such a key decision — important far beyond the two to ten percent of the plant investment which the system represents.

Seldom before has so much effective help been available in making the right choice and avoiding the profit-paralyzing consequences of the wrong selection. One example is the new book "Electric Power Distribution for Industrial Plants" published by the American Institute of Electrical Engineers. (It's obtainable for $1.00 from the Institute's offices at 33 West 39th St., New York 18, N. Y.) An entire chapter on wires and cables recognizes their key importance in providing plenty of power for plenty of years. For further help in selecting wires and cables, go over your plans with an engineer of The Okonite Company, Passaic, New Jersey or The Hazard Insulated Wire Works Division, Wilkes-Barre, Pa.



SEE CHAPTER SIX
"WIRES AND CABLES"

OKONITE insulated wires and cables

OKONITE SINCE 1878

4079

TOOLS

From pliers to pike poles — clamps to cable cars — tree trimmers to tamping bars, Graybar offers first-quality tools for every power line job. These tools are designed specifically to help linemen do the best work with the greatest safety. Special tools are available for hot-line jobs.

By making Graybar your headquarters not only for tools — but for hardware, poles, crossarms, strand, insulators, pins, and accessories — you will always be sure of getting the right materials for each job. *Graybar Electric Company, Graybar Building, New York 17, N. Y.*

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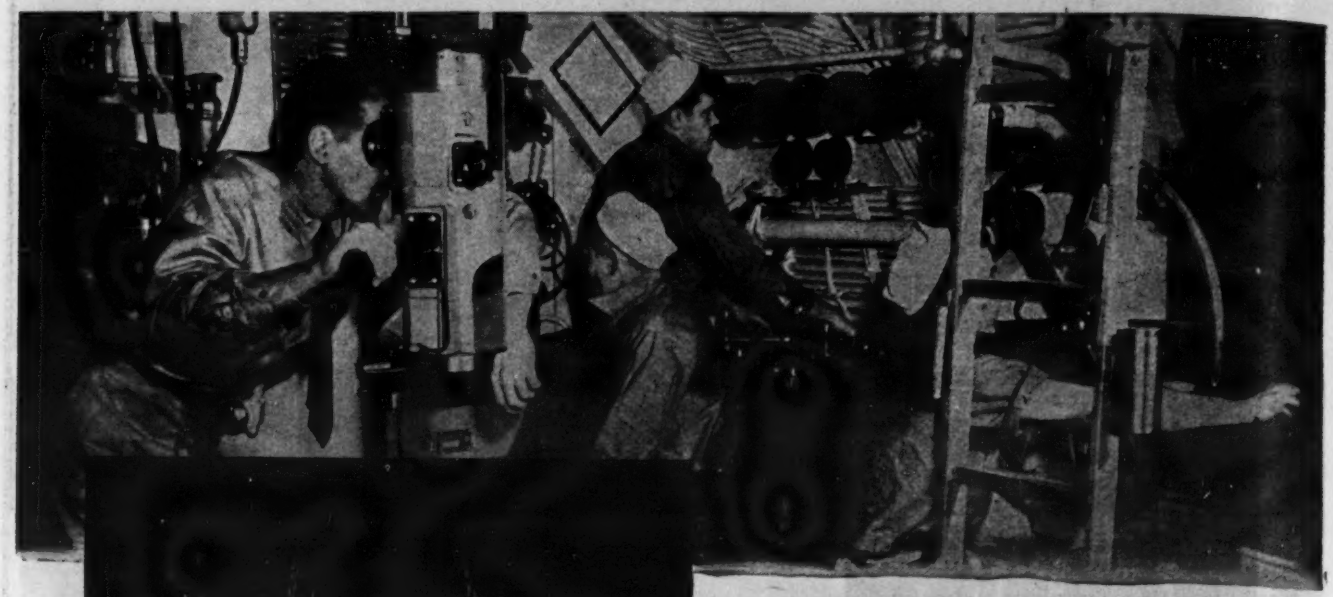
IN OVER 60 PRINCIPAL CITIES



BATTLE STATIONS *for a critical job*

The men in the control room of a submarine give the finest possible example of close teamwork. Every man has his job, and it's sink or swim together — all for one and one for all.

The same is equally true in building the propulsion equipment for a submarine. One of those crucial moments of teamwork in Elliott Company's Ridgway plant is illustrated in the photo, which shows a hot armature stacking being lowered for a shrink fit on the spider of a submarine motor.

The men in our Ridgway plant feel that they are brothers in arms of the men in the sub's control room. Though not as hazardous, their teamwork is quite as essential to Victory, in the proven reliability of Elliott motors.

ELLIOTT COMPANY
Electric Power Department, RIDGWAY, PA.
Plants at: JEANNETTE, PA. • RIDGWAY, PA.
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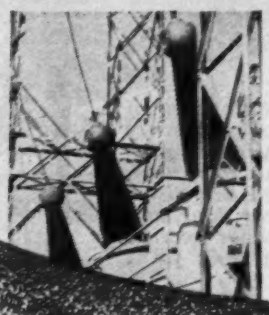
L-754B

STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS • FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES • TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

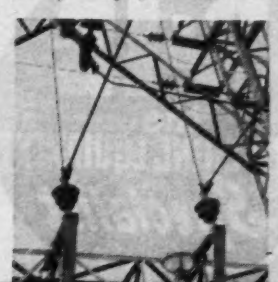
CHECK the FACTS
Metal Enclosed
ISOLATED PHASE BUS
1 Sealed, dust proof, individual bus housing provides phase isolation and prevents interphase short circuit. Removable covers in unit sections simplify routine inspection.
2 Supporting ring frames equalize all stresses. Can be mounted in any position.
3 With interchangeable insulator units always in compression, porcelain is used to its best advantage.
4 The same conductor support collar is used for both fixed and expansion slide position. Conductor can be square, round, channel or bar, insulated or bare.
The Check List
CONDUCTOR SUPPORTS CLAMPS AND FITTINGS
DISCONNECTING SWITCHES INDOOR AND OUTDOOR
HORN GAP SWITCHES
INTERRUPTER SWITCHES
CUTOUTS AND THERMO-RUPTERS
DISTRIBUTION EQUIPMENT
SUBSTATIONS
OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
KIRK INTERLOCK SYSTEMS
AUTOMATIC SECTIONALIZING EQUIPMENT
METAL CUBICLES
TESTING DEVICES
R&IE the SWITCHING EQUIPMENT Specialist
The installation shown is part of a recently completed hydro project. Shown here are two views; left — Isolated Bus risers from generator floor, and above — outdoor section to transformers in yard.
RAILWAY AND INDUSTRIAL ENGINEERING CO.
Greensburg, Pa.

WHEN YOU INSULATE

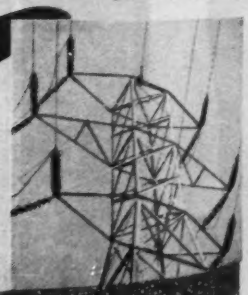
Porcelain internal dielectric is unique in O-B bushings. This trusted and wholly reliable insulation gives O-B bushings the rugged characteristics common to all porcelain line insulators.



Porcelain in O-B station insulators--of course. But how that porcelain is made; how it is assembled with metal parts; how it is inspected and tested; gives them reliability that pays dividends



Porcelain in suspension insulators is an old story, but a porcelain and metal combination that can be guaranteed to have a specified minimum strength is something else. O-B gives you this.



THROUGHOUT WITH O-B

IT'S *Porcelain* ALL THE WAY

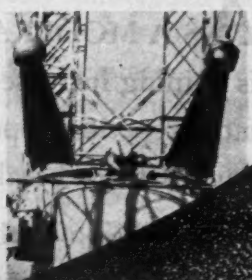
Unique among bushing designs is O-B's use of porcelain as an internal dielectric. Yet--stop and think for a moment--porcelain insulation is universally used everywhere else in power transmission. It is the most practical, most rugged, most all-around satisfactory insulation yet devised.

Porcelain dielectric doesn't change with time; endures high temperature; is un-harmed by flashover. This makes it possible to flashover-test every O-B bushing part before assembly.

Porcelain is such a common-sense insulation, and so broadly understood, that when used inside a bushing its advantages become immediately apparent to the experienced power man. When you use O-B oil-filled, porcelain-insulated bushings, your line is porcelain-protected right to the windings of your apparatus, and behaves as you have learned to expect it to behave with this tried and trusted dielectric.

2601-H

O-B oil-filled, porcelain-insulated bushings--porcelain inside as well as outside--resist elevated operating temperatures brought about by today's unexpectedly high wartime requirements for power.



Porcelain in all of its aspects can be specified in a station insulator, yet you still don't define those qualities that give it long life, and that mean the most. Check O-B's 30-year-old record.

Porcelain never works harder--never needs to be better--than in a pintype insulator that must "take it on the chin" when lightning starts. O-B pintypes embody great manufacturing care.

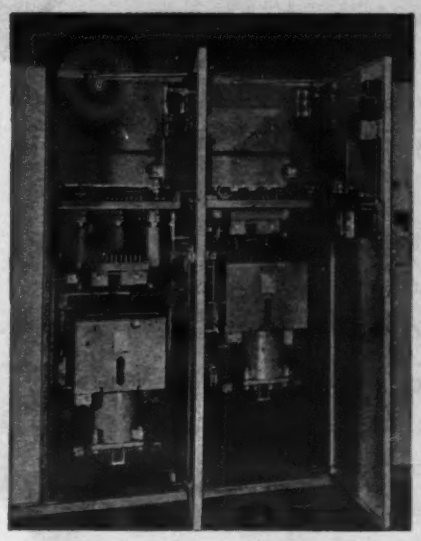
Ohio Brass

MANSFIELD, OHIO, U. S. A.

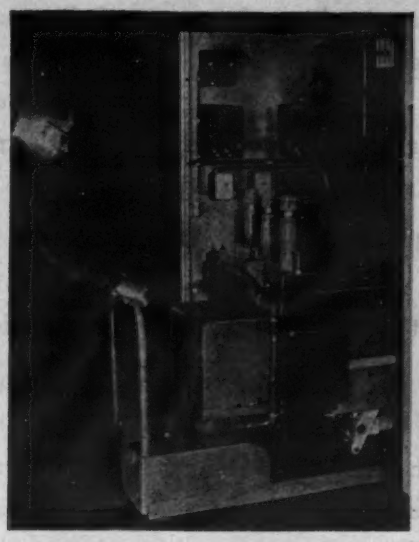
CANADIAN OHIO BRASS COMPANY, LTD., NIAGARA FALLS, ONTARIO

See How Easy it Is to

ROUTINE CONTACT INSPECTION IN 3 QUICK STEPS ON OILLESS "RUPTAIR" MAGNETIC AIR BREAKER



1 LOWER BREAKER. Photo shows "Ruptair" magnetic air breaker in operating position (at right) and in the lowered disconnect position. The breaker is easily lowered with manually or electrically operated crank-hoist.



2 WITHDRAW BREAKER. In disconnect position, the "Ruptair" breaker can be placed on a transfer truck, and pulled out into the aisle. For safety, shutters to isolate disconnect contacts are automatic in operation.

3 REMOVE SIDE PLATES. Finally, light-weight insulating barriers are removed, each barrier being held in place by two cap-screws. Since the arc chute is above the contacts, it need not be disturbed for contact inspection.

AS A MODERATE capacity, oilless circuit interrupter, the "Ruptair" breaker is gaining increased popularity among operators. Elimination of oil means many more repetitive operations without maintenance . . . reduced fire hazard . . . less danger from breaker failure.

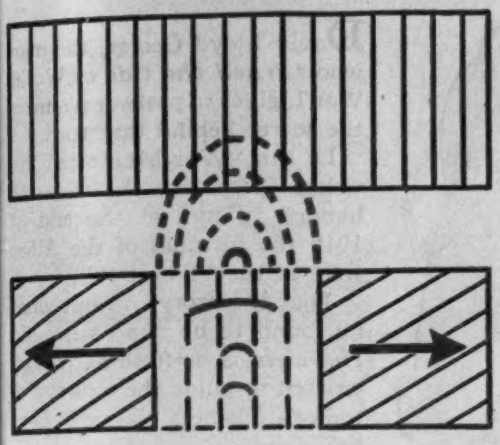
In addition to these advantages, and simplest inspection of any magnetic air breaker, the "Ruptair" breaker combines space saving vertical lift construction with horizontal contact separation, shown at top of opposite page. "Ruptair" circuit breakers are built in standard ratings of 5 kv and below, 150,000 kva interrupting capacity and below, for installation in metalclad switchgear, cells, or cubicles. To get the full story, write Allis-Chalmers, Milwaukee 1, Wis.

♪ *Tune in the Boston "Pops", Blue Network, Saturdays at 8:30 pm, EWT.*

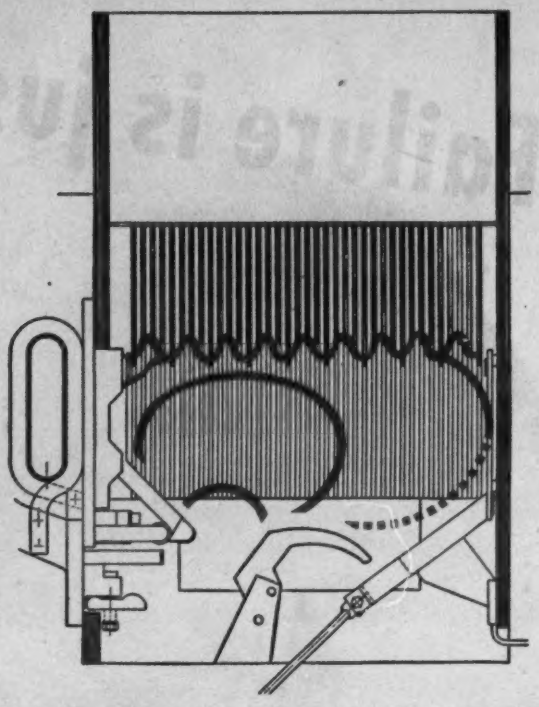
Inspect

A "RUPTAIR" MAGNETIC AIR CIRCUIT BREAKER

WITH HORIZONTAL SEPARATION OF BREAKER CONTACTS, MAINTENANCE AND OPERATION ARE SIMPLIFIED



SINCE THE ARCING contacts on a "Ruptair" magnetic air circuit breaker are separated in the horizontal direction, natural thermal effect assists the arc into the arc chute . . . no complex interrupting structure is required! Position of arc chute *above* contacts makes it possible to inspect contacts without removing the chute. Maximum interrupting effectiveness is achieved in the "Ruptair" circuit breaker, without departing from ideal simplicity of design.



RUPTAIR BREAKER HAS UNIQUE DESIGN

THE RUPTAIR breaker depends for its high efficiency throughout interrupting current range on several design factors . . . coordination of horn-shaped moving contact and arc runner for quick transferral of the arc . . . establishment of a strong magnetic field in the breaker before actual contact separation . . . and special design of the arc chute.

Why Allis-Chalmers offers all 3 types of Circuit Breakers

☛Ever hear of "special theater modifications"? That's a military term, and refers to the adaptation of aircraft to unusual flying conditions, such as are encountered in Central Alaska, or in torrid tropical climates.

☛An airplane built for special theater operations often differs in practically every detail from a plane designed for duty under normal atmospheric conditions. That is, the Army and Navy have learned that *one* type of plane can't function in *all* theaters of war!

☛*For the same reasons, Allis-Chalmers engineers know that one type of circuit breaker won't do the job in all the varied environments encountered in industry.*

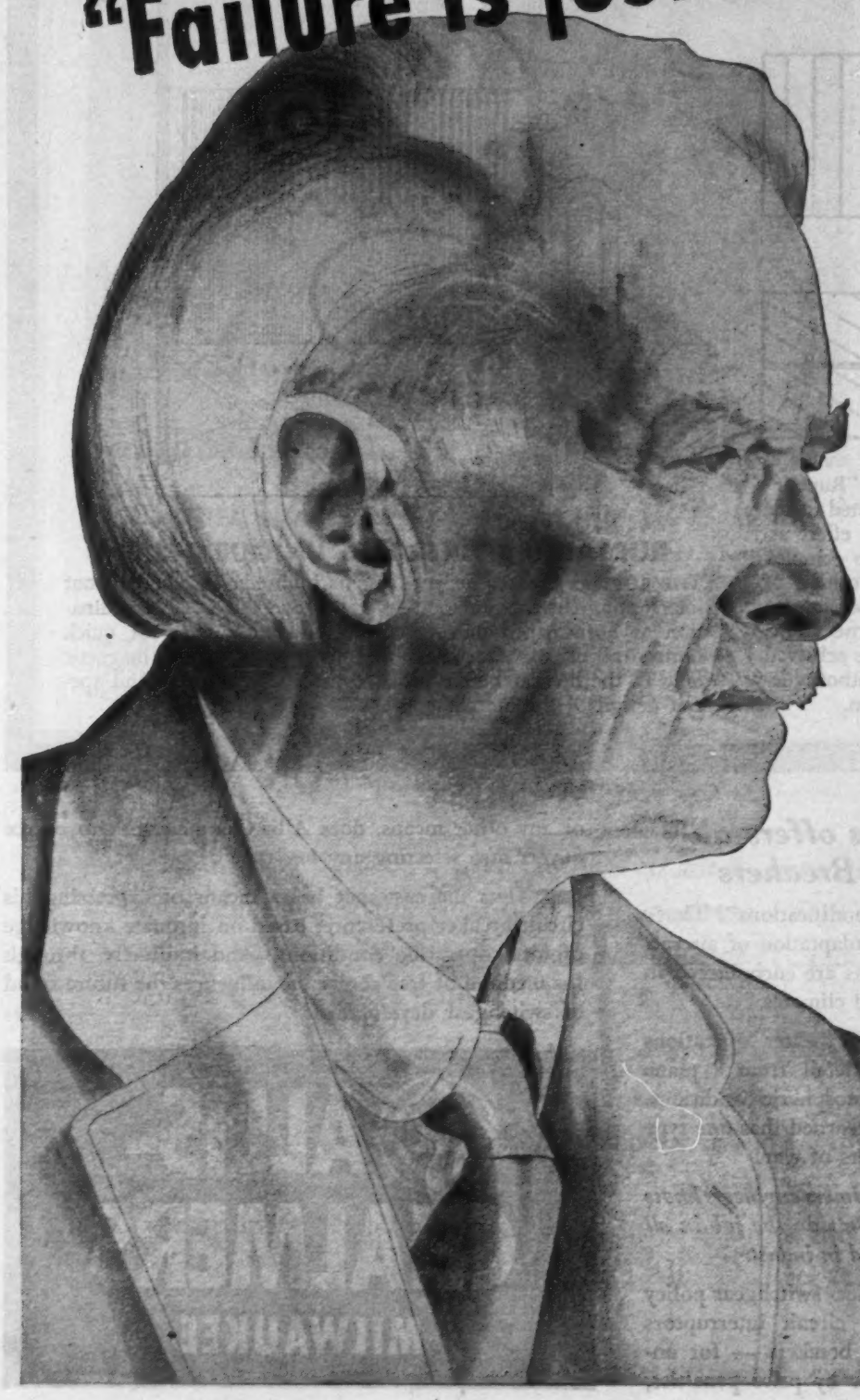
☛Therefore, it is an Allis-Chalmers switchgear policy to offer *all three* basic types of circuit interruptors — oil, magnetic air, and air blast breakers — for unrestricted customer choice. Neither by price penalties, or any other means, does Allis-Chalmers seek to coerce buyers into selecting any *one* type of breaker.

☛Thus the customer has a means of expressing his circuit breaker preference, based on intimate knowledge of local operating conditions. And indirectly, through the medium of free choice, he influences the future trend of switchgear development. A 1863

A-C ALLIS-CHALMERS MILWAUKEE

then he said to himself

"Failure is just a symptom"



David Lloyd George, the man who *turned the tide* of World War I, gives to postwar planners the secret behind that turn.

In his "War Memoirs" he writes that when the war was handed to him at the end of 1916 the fortunes of the Allies were at their lowest ebb.

That is history . . . but what he found to be *the cause* and *the cure* is as fresh as though written to guide the strategy of today's business planners. Says he:

> "Two failures on key questions had completely transformed the military position to our disadvantage. The first was the failure to realize that this was a war of machinery . . . and we had neglected to *improve* the Allied equipment."

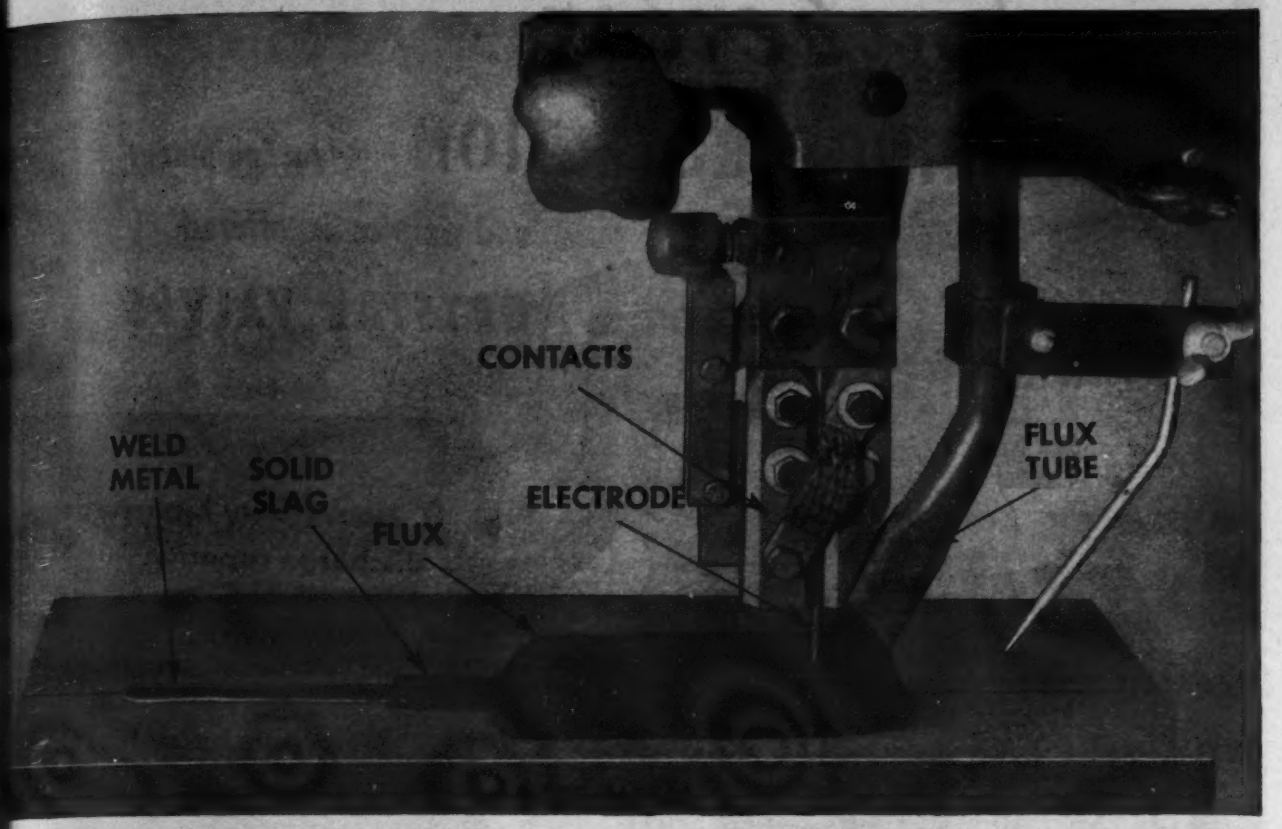
This proves he is a good business man to make that discovery . . . and a better man to ACT before it is too late.

Neglecting to improve equipment, and production, and cost is the surest road to the valley of any business curve.

. . . But for climbing out, and up . . .

"IMPROVEMENT...the key," *he says*

Look, "L. G.", how Lincoln has improved the Shielded Arc Welding Process:



...e Pioneer of Shielded Arc Welding Announces "LINCOLNWELD"

. . . key to better welding at lower cost

...elded completely under a blanket of flux, the arc of "Lincoln-...ld" brings to the welding world new high standards of *speed, ...ality* and *economy*. Here are a few of the many advantages ... this new Lincoln Automatic Metallic Shielded-Arc Process ... reported by many users for a wide variety of applications:

...SATILE. Same flux . . . same electrode . . . same procedure . . . ... be used for wide range of steel analyses. With simple change ...electrode size, same equipment welds thin sheets or heavy plates.

...Y TO WELD HORIZONTAL FILLETS. Simple to change from butts to ...ts or laps. Deep-root penetration combined with high welding ...eds assure welds of higher quality at lower cost.

PRODUCES HIGH QUALITY WELDS. "Lincolnweld" Flux gives quality results even in many steels of poor weldability.

ARC CONTROL IS SIMPLE. Balanced voltage type d.c. control . . . highly sensitive yet rugged and dependable.

TAKES WIDE RANGE OF ELECTRODE SIZES. Accommodates ⅛" to 7/32" electrode without change in head or control.

NOT SENSITIVE TO POWER LINE VOLTAGE VARIATIONS. Assures weld uniformity at all hours of day or night even though there may be voltage variations in shop power.

A booklet has been compiled giving "Lincolnweld" facts, procedures and results in a variety of applications. A free copy is yours for the asking.

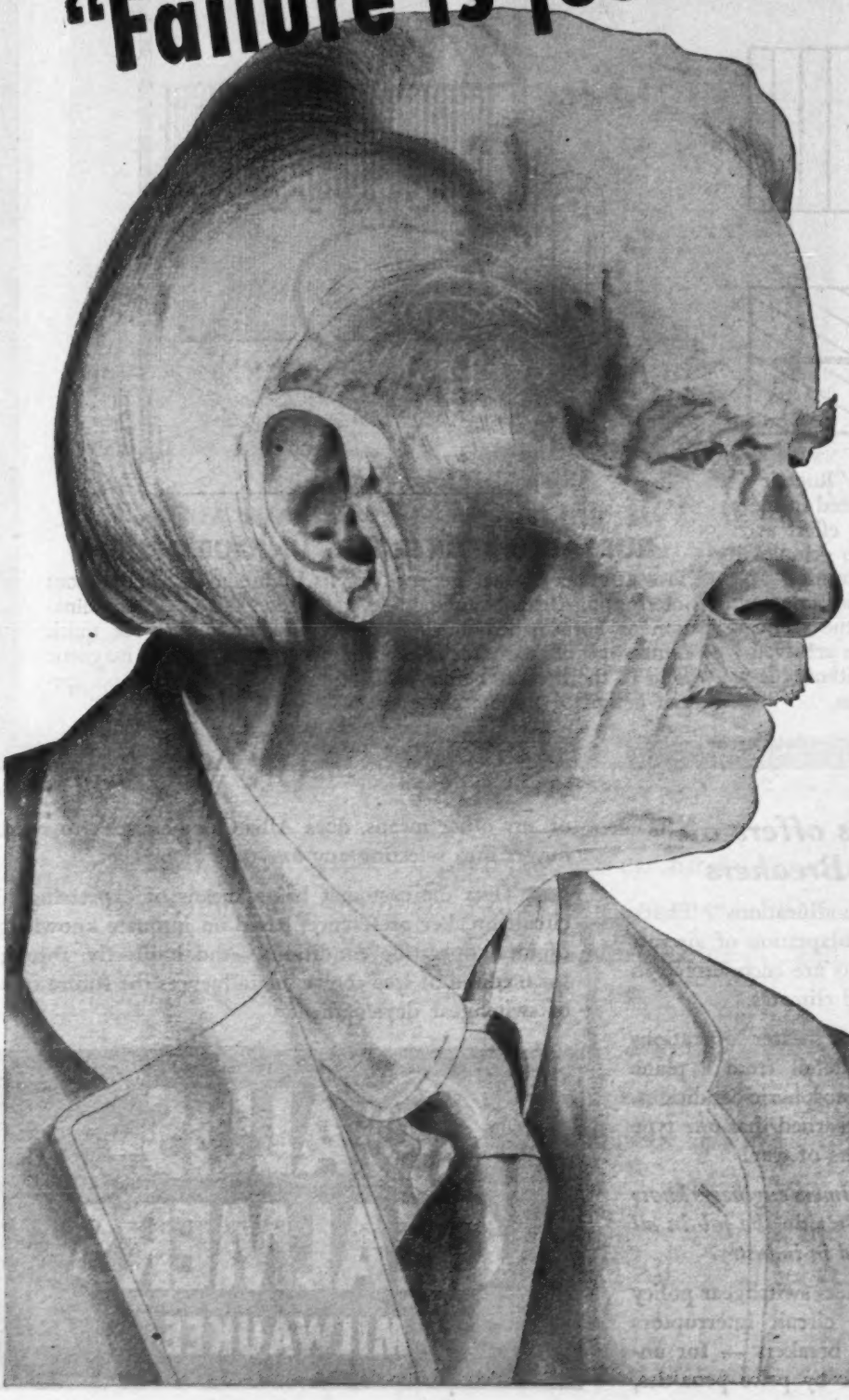
THE LINCOLN ELECTRIC COMPANY • DEPT. G-2 • CLEVELAND 1, OHIO

America's greatest natural **recourse**

ARC WELDING

then he said to himself

"Failure is just a symptom"



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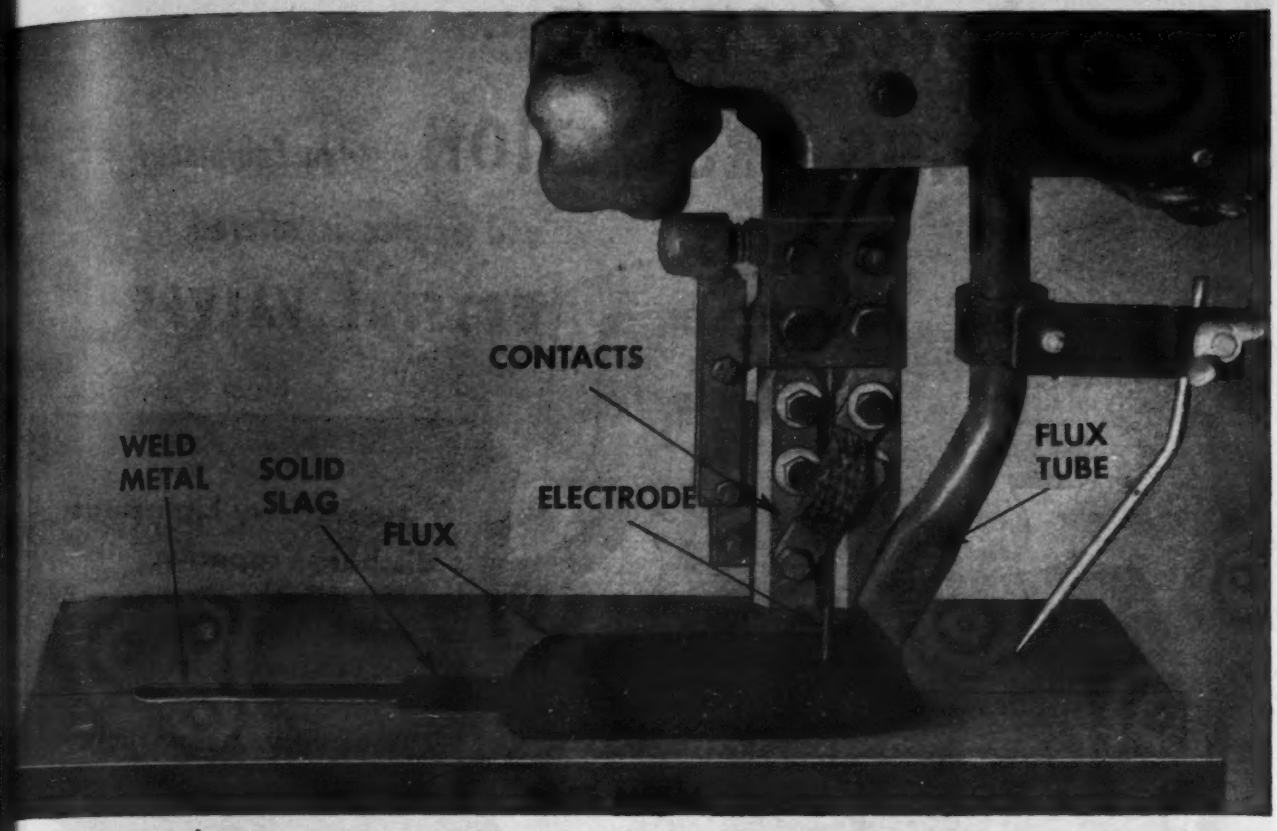

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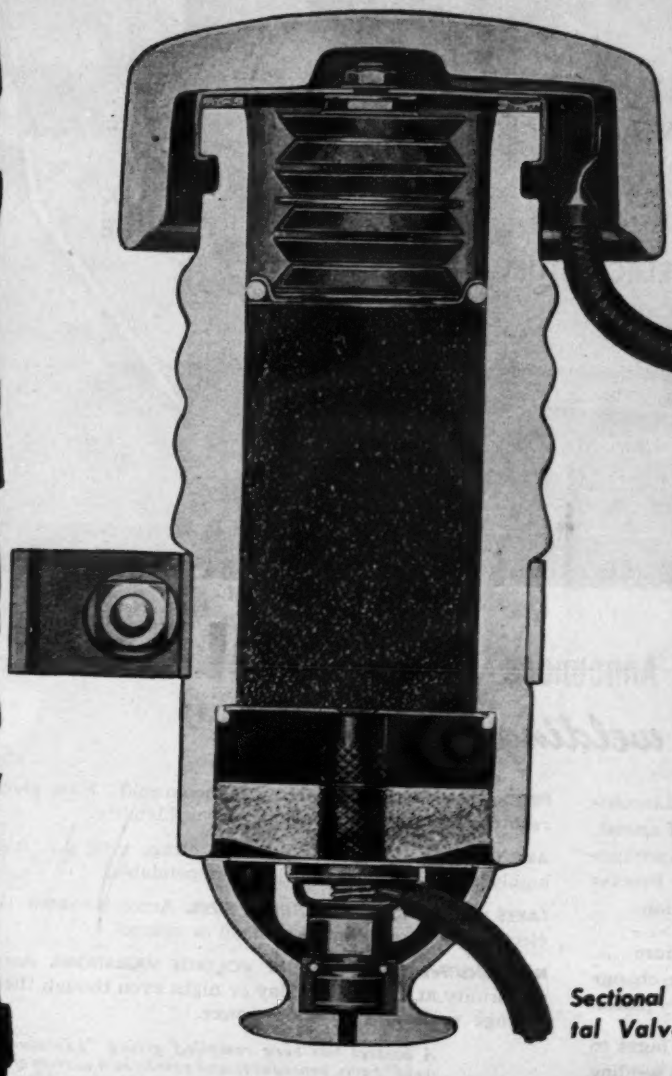
America's greatest natural **recourse**

ARC WELDING

Superior

LIGHTNING PROTECTION . . . *to Equipment and Service is offered by*

CRYSTAL VALVES



- Heavy Duty high surge discharge capacity.
- High Speed low impulse breakdown voltage.
- True Valve Action for follow current interruption.
- Low IR Drop — surge voltage reduction.
- Low Maintenance and long life.

Sectional View of Typical Crystal Valve Lightning Arrester

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CRYSTAL VALVE

LIGHTNING ARRESTERS

SNW Wire Insulation made from GEON approved by Underwriters' Laboratories

TESTS PROVE EXCEPTIONAL STABILITY OF ELECTRICAL PROPERTIES

WIRE insulation made from GEON has been approved by Underwriters' Laboratories for use in wet locations, eliminating the need for lead sheathing. Besides this advantage, GEON permits the use of thinner insulation and makes possible a smaller diameter wire—thus more conductors and more power per conduit. Other characteristics of GEON make possible an insulation which does not require a protective braid and which has superior all around long-time aging and electrical properties.

How's this for a test of an insulating material—*immersed in water for 106 days at 70 degrees C.* (This test conducted by Electrical Testing Laboratories, Inc.) Insulation made from GEON stood that test, and came out with its electrical properties practically unchanged!

SNW insulation made from GEON is flame resistant, self-it extinguishes itself, an added important property in wet locations where exposed connections increase the danger of short circuit and fire. Corrosive conditions are common in wet locations. But they have no effect on insulation of GEON which resists the action of acids, alkalies, oil, greases, mildew, heat, cold and many other normally destructive factors.

Urgently needed for military uses, all the GEONS are subject to allocation by the War Production Board. Our development staff and laboratory facilities are available to help you work out any special problems in connection with essential applications. For more complete information write Department CC-5; Chemical Division, The B. F. Goodrich Co., 324 Rose Building, Cleveland 15, O.

Geon
Polyvinyl Materials

CHEMICAL DIVISION
The B. F. Goodrich Company
324 ROSE BUILDING • CLEVELAND 15, OHIO

HOW EXCELLENCE IS BUILT INTO

Sangamo

MICA CAPACITORS

• The above picture shows a group of operators assembling by hand the mica films and foil used in the manufacture of capacitors of small capacitance values. Special assembly fixtures are used to insure accurate positioning of component parts.

SANGAMO ELECTRIC

ESTABLISHED 1898 • • • MICA CAPACITORS • •

★ *This operator is assembling mica and metal foils to form a unit which constitutes the essential element of a mica capacitor. Hand operators are utilized where only a few sheets of mica and foil are required for units of low capacitance value. Specially trained operators insure proper placing of component parts, resulting in a finished product of high quality.*

Hand Stacking

Capacitors utilizing mica as a dielectric are manufactured in a complete range of sizes, from very tiny wire lead units having capacity values of as low as 5 mmfd. to large ceramic-housed units having capacities which may be as high as several microfarads. Voltage ranges, too, vary from small units having dielectric strength test of only 300 volts or less, to those units built to withstand 40,000 or 50,000 volts or more.

In the manufacture of the large units, the stacking of the mica element is performed by special machines designed for that purpose. In the manufacture of the very small units with low capacitance values, plates are sometimes utilized and it is, consequently, impractical to stack these with automatic equipment. In these cases, hand-operators are utilized who become very skillful in stacking the alternate layers of foil and mica, and in keeping the exact alignment so necessary for the production of a good capacitor.

Where special characteristics are required, a silver deposit is sometimes placed on the mica and fired on, and thus becomes the conducting plate in the capacitor assembly. By firing silver on mica, very intimate contact is made with the dielectric, and as a consequence, stability, that is, capacitance drift, is improved and special temperature characteristics obtained. It is essential that the silver coating be of uniform texture, with clean, well defined edges, so as to prevent excessive corona and ultimate voltage breakdown of the capacitor unit. Sangamo builds many thousands of the silver mica capacitors each day and is well equipped to produce and test these units in accordance with the required characteristics.

☆

OMPANY SPRINGFIELD ILLINOIS

• WATT HOUR METERS • • • TIME SWITCHES • • •

hold tight because

★ **HIGH PRESSURE GIVES TIGHTER WIRE CONTACT**

★ **HIGH COPPER CONTENT GIVES HIGH CONDUCTIVITY**

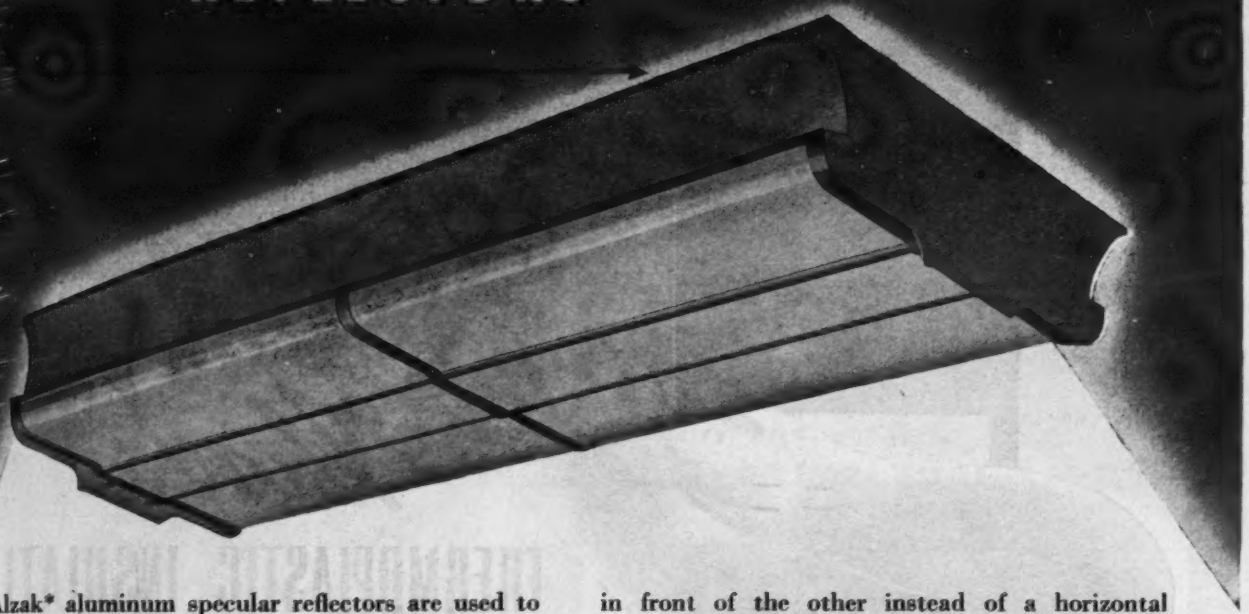
★ **MACHINE CUT THREADS GIVE HIGHER PERMISSIBLE TORQUE**

IMMEDIATE DELIVERIES ON TYPES AND SIZES FOR EVERY REQUIREMENT

MADE BY KYLE CORPORATION

ALZAK* ALUMINUM

REFLECTORS



Alzak* aluminum specular reflectors are used to obtain maximum efficiency and control, in the new Tandemlamp patented by The Doane Products Corporation, Meriden, Conn., represented by Ivan T. Johnson Company, Inc., New York.

This interesting fluorescent lighting fixture uses an axial plane mounting which places one lamp in front of the other instead of a horizontal arrangement. This mounting, the manufacturers say, permits the light from each lamp to be reflected symmetrically from a smaller reflector as illustrated in the drawings.

Alzak* aluminum reflectors were selected to assure permanence and high reflectivity. An oxide coating provides surface protection and the high reflection is the result of a special electrolytic treatment** of suitable aluminum sheet prior to applying the anodic finish. ALUMINUM COMPANY OF AMERICA, 1978 Gulf Building, Pittsburgh 19, Pennsylvania.

*Registered trade mark
**Patented Process, A. C. of A.

Drawings of Doane Products Corporation Showing Waste Light Areas

ALCOA

ALCOA ALUMINUM

...n special-
...g a complete
...e wires to heavy
...bles . . . serving: Public
...ities, Radio, Electronic, Ap-
pliance and Instrument Manu-
facturers, Telephone Companies
and Contractors.

Now

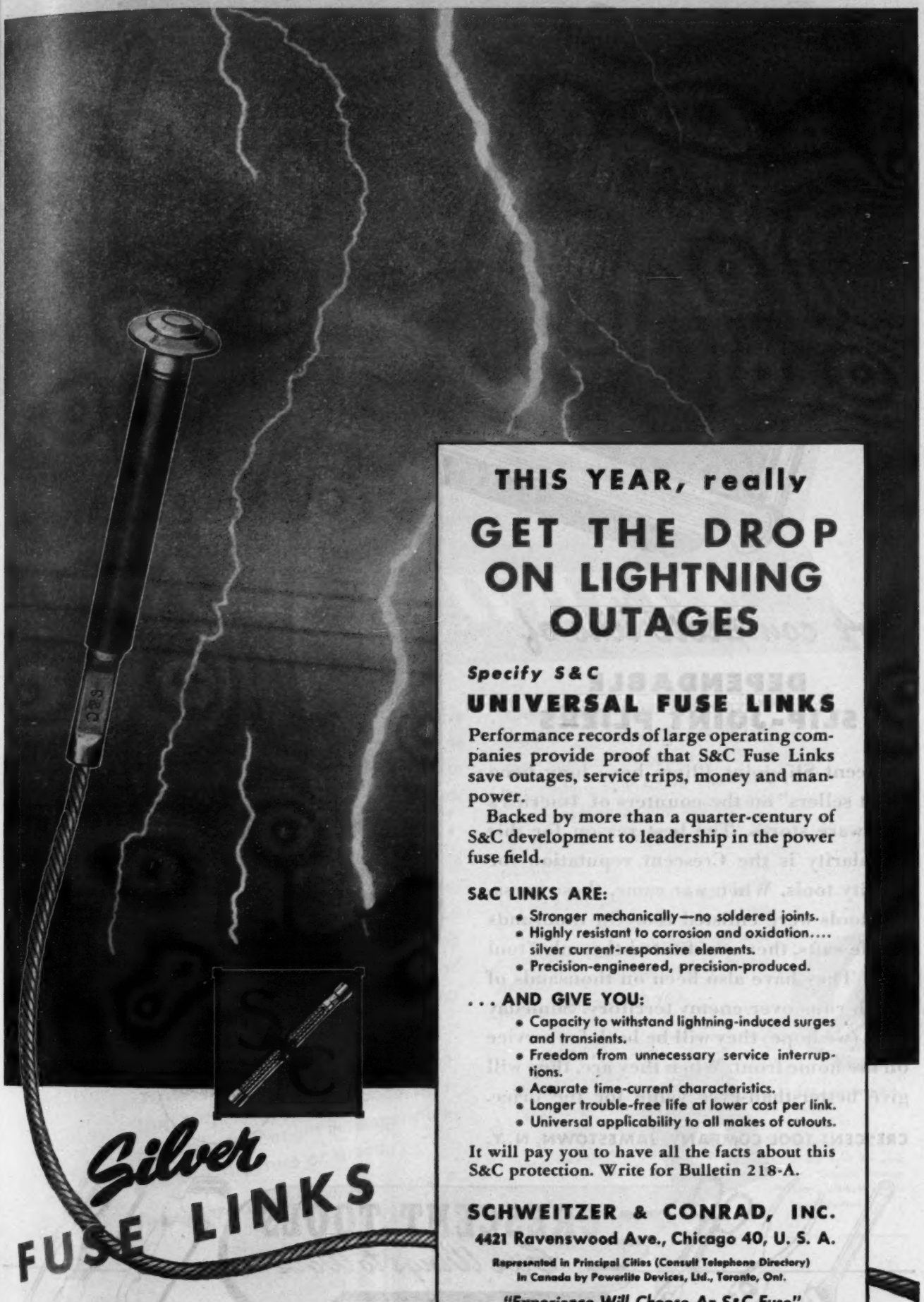
THERMOPLASTIC INSULATION

Nothing is constant but change . . . and in the wire and cable field the "change" to thermoplastic insulation has been tried and proved in the test tube of war. When victory is won you will demand the maximum resistance which these new compounds and constructions offer to heat, flame, oxidation, chemical action, oil, grease, moisture, cold, abrasion, fungus growth and other severe conditions. Write NOW for complete information and samples engineered to your particular requirements. Remember . . . when you're thinking of PLASTIC you're thinking of US!

PLASTIC

WIRE & CABLE *NORWICH CONN.*

CORPORATION



THIS YEAR, really

GET THE DROP ON LIGHTNING OUTAGES

Specify S&C

UNIVERSAL FUSE LINKS

Performance records of large operating companies provide proof that S&C Fuse Links save outages, service trips, money and manpower.

Backed by more than a quarter-century of S&C development to leadership in the power fuse field.

S&C LINKS ARE:

- Stronger mechanically—no soldered joints.
- Highly resistant to corrosion and oxidation.... silver current-responsive elements.
- Precision-engineered, precision-produced.

. . . AND GIVE YOU:

- Capacity to withstand lightning-induced surges and transients.
- Freedom from unnecessary service interruptions.
- Accurate time-current characteristics.
- Longer trouble-free life at lower cost per link.
- Universal applicability to all makes of cutouts.

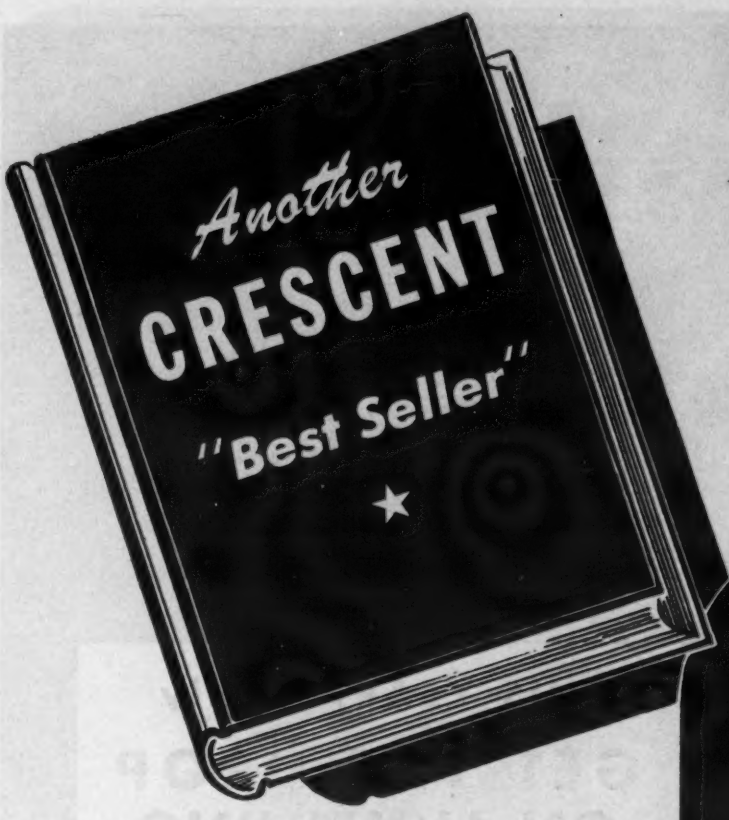
It will pay you to have all the facts about this S&C protection. Write for Bulletin 218-A.

SCHWEITZER & CONRAD, INC.

4421 Ravenswood Ave., Chicago 40, U. S. A.

Represented in Principal Cities (Consult Telephone Directory)
In Canada by Powerlite Devices, Ltd., Toronto, Ont.

"Experience Will Choose An S&C Fuse"



A complete line of

DEPENDABLE SLIP-JOINT PLIERS

Crescent Slip-joint Pliers have long been "best sellers" on the counters of America's hardware stores. The best reason for this popularity is the Crescent reputation for quality tools. When war came, these versatile tools were enlisted too. On thousands of life rafts, they constituted the only "tool kit". They have also been on thousands of bomb runs over enemy territory. Someday soon (we hope) they will be back for service on the home front. When they are, they will give better-than-ever value for the price.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

IT SAYS "WHERE"

Suppose you want a distant valve turned just so far—or a machine tool to be precisely controlled—or any of thousands such adjustments taken care of.

This is achieved with Lear Remote Controls—precise electrical devices which regulate the motion to just what is ordered. In other words, you set the dial at what you want and the control takes over and says exactly "where."

Where it is an advantage, the control may be set to respond automatically to changes in temperature, position, pressure or speed.

There are more instances where such controls are needed in industry than we can mention—or that we even know of. Perhaps you have an application now where one would save you time, money and expense or perform a function hereto impossible.

If you have, please write and let us know. While our engineers are applying these controls to war needs, they will be glad to discuss your problems with you.

LEAR,
INCORPORATED
PIQUA, OHIO

formerly Lear Avia, Inc.

Lear INCORPORATED

LEAR, Incorporated
Dept. 81
Piqua, Ohio

Gentlemen:
Please send me your free booklet showing Lear equipment and its many applications.

Name_____

Address_____

City_____ State_____

USE THIS Simplified INSTALLATION!

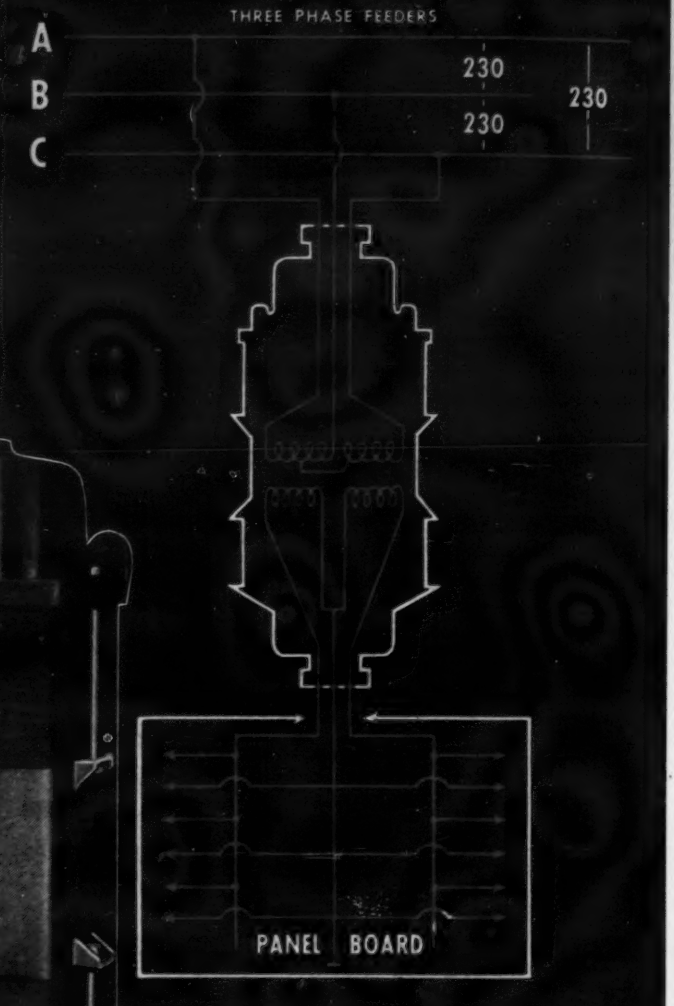
TO BALANCE LIGHTING LOAD ON 3 WIRE 3 PHASE FEEDERS

Advantages

OF AMERTRAN PHASE CHANGING TRANSFORMERS

- **Simplifies Installation**
- **Improves Voltage Regulation**
- **Long Term Satisfaction**
- **More Efficient Use of Existing Three Phase Distribution Facilities**
- **Balances Loading on Three Phase Feeders**

USE THIS CIRCUIT WITH AN AMERTRAN PHASE CHANGING TRANSFORMER TYPE CFP



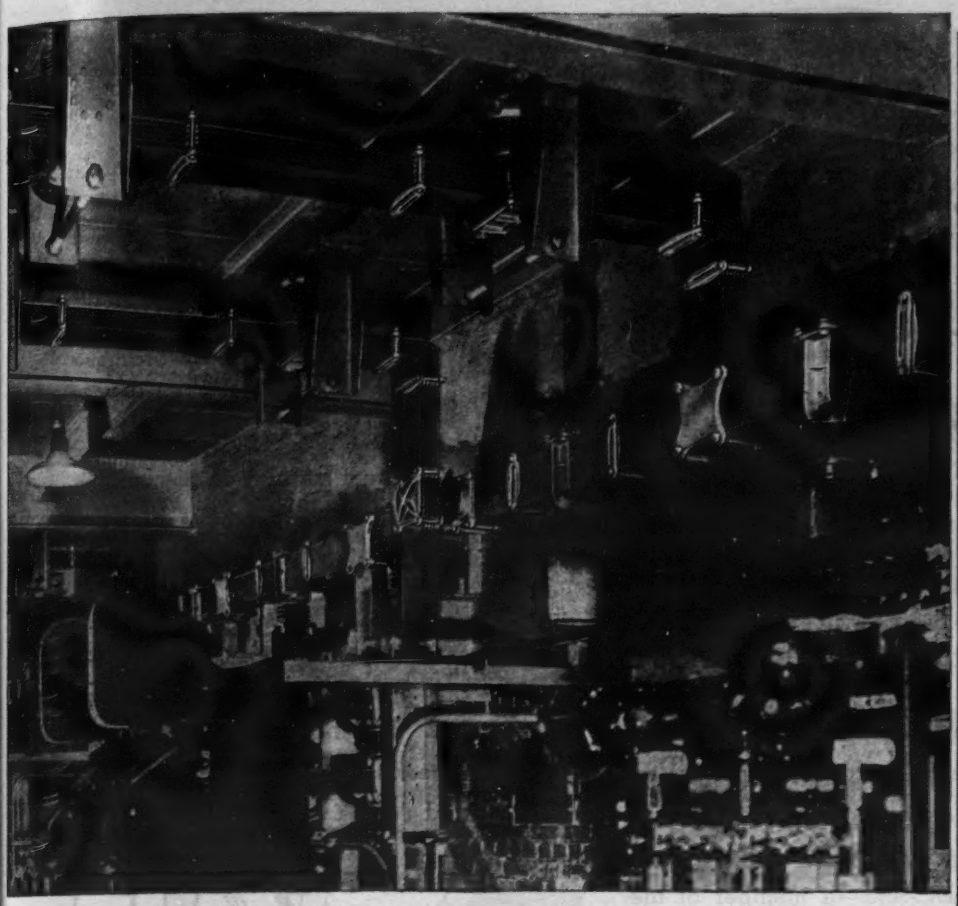
The use of AmerTran Type CFP Phase Changing Transformers in original installations on three wire, three phase circuits offers substantial economies to the user as well as advantages to the contractor and utility. It is a quick, convenient, inexpensive way to correct an unbalanced condition by connecting an existing single phase lighting load to a three phase supply. Complete information will be furnished upon request.

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERICAN TRANSFORMER CO., 178 Emmet St., Newark 5, N. J.



Low-Loss Anaconda Bus Conductors

FOR EVERY POWER TRANSMISSION REQUIREMENT

WHEN there's electric power to transmit, COPPER offers long-recognized advantages. High conductivity (both electrical and thermal) . . . strength . . . high corrosion resistance and moderate cost make copper the logical choice for bus installations.

There's an Anaconda Copper Bus Conductor shape for every transmission requirement. Send for Bus Conductor Booklet, C-25, or consult with The American Brass Company Technical Department.

BARS requiring minimum space may be bent or twisted, connected to apparatus without special joint preparation, and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS with large surface area and ventilation feature, reduce temperature rise, have greater rigidity for long runs than tubes, flat surfaces for tap-off.

ANGLES for ventilated hollow busses with highest rate of heat dissipation, handle greater current density but require more space for installation.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as arc or resistance furnaces.

42141

BUY WAR BONDS
Saved Dollars mean Saved Lives.

ANACONDA

Anaconda Copper

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

SILICONE

DC-993

A new value in Insulation

Now—for the first time—an insulating varnish is available that approaches Fiberglas, mica and asbestos in ability to resist heat, moisture and corrosive fumes. This new varnish is DC-993—a member of the new chemical family of SILICONES.

Silicones—a modern chemical miracle—are a new group of chemical compounds made from sand, brine, coal and oil. A new semi-inorganic group of compounds obtainable in liquid, plastic and other forms.

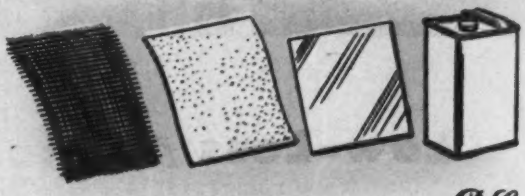
Sand + Coal + Brine + Oil

DC-993 is the member of this new silicone group that is best suited for use as an insulating varnish. DC-993 is a joint development of Dow Corning chemical research and Westinghouse "know-how".

Why Use DC-993?

The vulnerable component in ordinary varnish is organic carbon. When Fiberglas, asbestos or mica is bonded with an organic varnish, lack of heat stability in the varnish cancels many of the advantages of these heat stable materials.

In DC-993, the carbon skeleton of the resin is replaced by a chemically inert silicon. So, in DC-993, we have an insulating material that approaches Fiberglas, mica or asbestos in ability to resist heat, moisture and corrosive fumes.



Fiberglas Asbestos Mica *DC 993*

How is DC-993 Applied?

DC-993 is applied by dipping, spraying or brushing like any ordinary insulating varnish—the only difference being, a baking temperature of 250 deg C (482 deg F) is required to set DC-993.

Advantages of DC-993

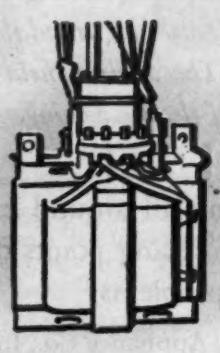
1 Service life of electrical insulation is increased many times.

2 Greater protection against excessive ambient temperatures and overload temperatures than is possible with conventional insulating varnishes.

3 Greatly increased protection from moisture and chemical laden atmospheres . . . because DC-993 is inert and does not become cracked or crazed after long service.

Proof—The improved insulating values of DC-993 have been proved both in laboratory tests and in service.

For instance—In one laboratory test, magnet coils insulated with DC-993 have been in operation over 10,000 hours at an observed temperature of 275 deg C (552 deg F).



For instance—A large number of magnet coils of various types insulated with DC-993 are in operation on street railway controls and records indicate a life considerably longer than Class B insulated coils.

For instance—A generator insulated with DC-993 ran 3000 hours at a temperature of 250 deg C (482 deg F), equal to a tremendously longer life at a normal operating temperature than obtainable with any other insulating varnish.

DC-993 is Available Now

DC-993 insulating varnish is available for immediate shipment in one, five, ten and fifty-gallon containers—also Fiberglas or asbestos insulating cloth, tape, tying cord and sleeving coated with DC-993; and Fiberglas and mica combinations can be supplied.

Write for descriptive booklet on DC-993. Write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-06381

Westinghouse

INSULATING MATERIALS

Take Advantage of Hotpoint-Edison's Advertising

in your Customers' Trade Magazines

TURN "Load Drop" troubles to your advantage by following up Hotpoint-Edison's hard-hitting advertising campaign. Prospects for commercial electric cooking are being created by this advertising. They are the customers to whom you can look for added revenue when "war-time load" falls off.

●● *Over one million Hotpoint advertising messages are reaching hospitals, restaurants, schools and hotels to stimulate this rapidly growing trend to electric cooking. The civilian field is being consistently sold on the broad benefits of electric cooking. It is receptive . . . your field is unlimited.*

●● The efficiency, economy and all-around excellence of commercial electric cooking are selling points that will "lay the ghost" of your Load Drop problems.

Edison General Electric Appliance Co., Inc.
5618 W. Taylor Street, Chicago 44, Illinois·

Hotpoint Dependability Assured by 40 Years Experience!

HOTPOINT REGIONAL SALES OFFICES. EASTERN: 570 Lexington Ave., New York City 22, Plaza 3-9333
SOUTHERN: 304 Red Rock Building, Atlanta 3, Walnut 2959
CENTRAL: 1456 Merchandise Mart, Chicago 54, Superior 1174
WESTERN: Western Merchandise Mart, 1355 Market Street, San Francisco 3, Underhill 2727
IN CANADA: Canadian General Electric Co., Ltd., Toronto, Ontario

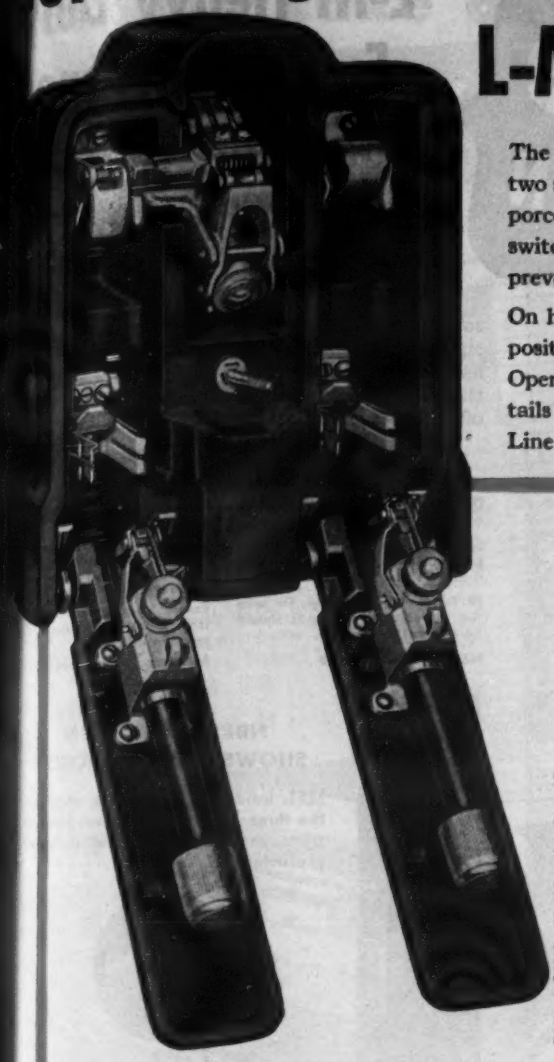
OLDEST AND LARGEST MANUFACTURERS OF ELECTRIC COOKING EQUIPMENT

HOTPOINT EDISON

COMMERCIAL ELECTRIC COOKING EQUIPMENT

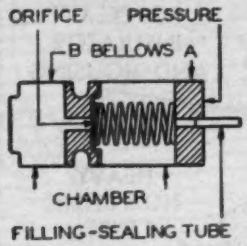
RANGES · BAKE OVENS · ROASTING OVENS · DEEP FAT FRY KETTLES · BROILERS · GRIDDLES

ut Outages, Save Maintenance, with L-M Reclosing Fuse Cutouts



The L-M Circuit Reclosing Fuse Cutout RP2-56, shown at left, consists of two single-shot drop-out cutouts and a time-delay switching mechanism in a porcelain housing. When the link in the first cutout blows, the mechanism switches the circuit to the second cutout after a fault-clearing time lapse that prevents needless blowing of the second link under temporary faults.

On his next trip the lineman sees the cartridge tube in the indicating down position, and either re-fuses the door or exchanges it with a spare fused door. Operation of the RP2-56 is fully automatic; no resetting necessary. Get details from the L-M Field Engineer; call or write nearest L-M branch office or Line Material Company, Milwaukee 1, Wisconsin.



Simple Time-Delay Device

Two bellows, "A" and "B", are connected by a spring in chamber "C". Unit is filled with non-freezing fluid and sealed. When cutout No. 1 is in circuit, a lever presses on bellows "A". When No. 1 link blows, cartridge drops, releasing pressure on "A". Spring expands bellows "A" slowly as fluid is drawn through tiny orifice. Expansion of "A" actuates auxiliary contacts that switch circuit over to cutout No. 2. Re-fusing and replacing No. 1 cartridge restores pressure on "A" and disengages auxiliary contacts.

Design and Operation of L-M Reclosing Fuse Cutouts

1. When first link blows, cartridge drops to indicating position, easily seen from the ground by lineman.

2. Upper contact follows drop part way; arc clears in tube before contact breaks.

3. Drop-out actuates bellows time delay, which switches circuit to second cutout. Adjustable up to 1 second.

4. Replacing blown link automatically transfers circuit back to first cutout; no resetting needed. Impossible to have links in parallel.

5. Doors are always closed, protecting mechanism from dirt and weather; operation not dependent on doors.

6. Re-fused one link at a time, in any sequence, without opening circuit. All refusing on door, which is easily unhooked.

7. Heavy NEMA-standards contacts; recoil stops transmit shock to housing, not door.

Parts Fully Interchangeable

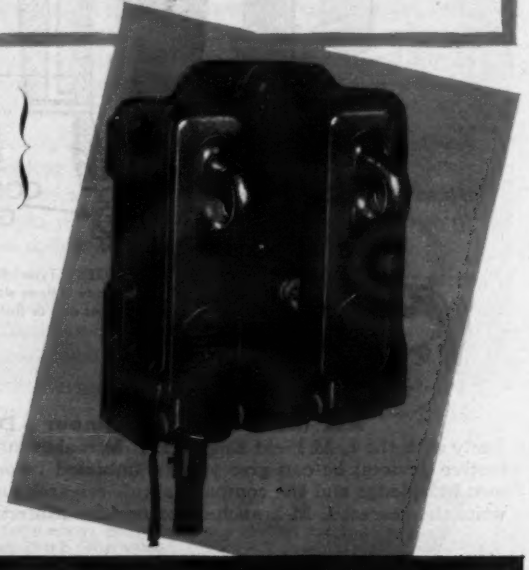
Cartridge units are permanently attached to doors, are removable as a unit with the doors. Lineman can re-fuse in 6 seconds by slamming on a spare, fused door. Parts interchangeable with type "PVD" Fuse Cutout of same rating. *RATING*, RP2-56: 5000 V. Δ., 50 amps.

Get this Folder

"Where L-M Reclosers Pay, and Why" Helpful information in brief picture-diagram on how to use reclosers. Write today for a copy—Line Material Co., Milwaukee 1, Wisconsin.

How to Make Reclosers of Your Present One-Shot Cutouts: Ask L-M about the RP-515 conversion unit—complete with time-delay switch.

Other Reclosing Cutouts up to 15,000 volts, 50 and 100 amperes—write L-M, describing your requirements. Ask for L-M Fuse Cutout booklet 44-101.

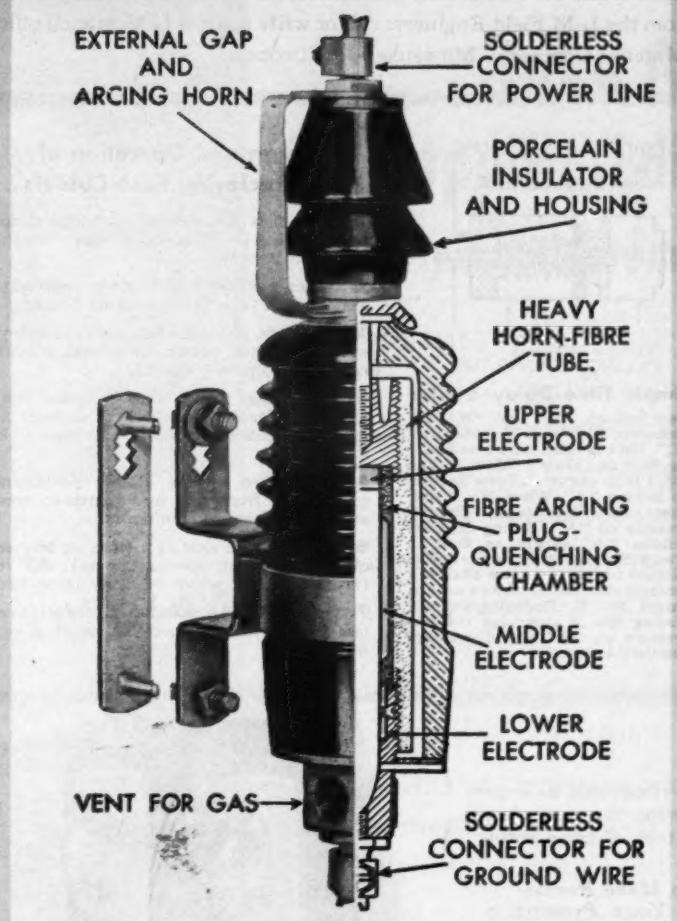


LINE MATERIAL

FUSE CUTOUTS & FUSE LINKS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters
Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

HOW TO GET safe LIGHTNING PROTECTION



SIZES: Type PF Expulsion Arresters are made in three sizes, rated at 3, 6, and 9 kv., cross arm or flat mounting hangers.

Ask the L-M Field Engineer—Discuss your requirements freely with the L-M Field Engineer. L-M makes many types of lightning protective devices; he can give you an unbiased recommendation based on his own knowledge and the company's wide research and field experience. Call or write the nearest L-M branch office or Line Material Co., Milwaukee 1, Wis.

L-M Heavy Duty Expulsion Type Lightning Arreste

L-M Heavy Duty Expulsion Type Lightni Arresters give a high degree of protecti Superior design assures low sparkover, low drop, and discharge capacity adequate handle severe surges with ample margin safety. L-M wedge-shaped arcing chamber is signed to keep fibre erosion at a minimum, th assuring long, trouble-free life. Get details fr the L-M Field Engineer, nearest L-M bran office, or Line Material Co., Milwaukee 1, W

FEATURES OF L-M TYPE PF EXPULSION ARRESTERS

Discharge capacity ample; passes 65,000-ampere surge test.

Sparkover sufficiently low for ample protection to transformer with a large safety factor.

IR Drop extremely low. To take full advantage, all leads should be as short as possible.

No Radio Interference

Follow current interrupted at of first half-cycle.

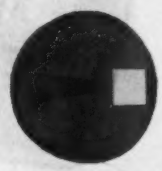
Long Service Life: wedge-sh design keeps erosion of fibre a minimum, assuring long, trou free service.

External gap insulates fibre pa from line voltage except fo surge conditions.

Moisture Seal not needed.

FIBRE GAP DESIGN SHOWS L-M SUPERIORITY

LEFT: Inside of fibre arcing chamber the three electrodes form two internal gaps, and provide excellent sparkover characteristics.



Cross section of chamber. Wedge presses arc into thin sheet, so that even small follow currents are promptly extinguished. Wide part is ample space for venting the gases.

As a surge reaches arrester, it sparks over extern gap at top, jumps the two internal gaps, then flow to the ground, thus protecting transformer fro damage.

The 60-cycle current tends to follow the surg and maintain the arc. To interrupt this follow current is the function of the fibre arc-extinguish ing chamber.

The arc produces gas from the fibre in the wedge shaped passage. This gas quenches the arc by ex pulsion action at the end of the first half cycle the instant the current passes through zero.

Long intermediate electrode exposes a large area of fibre to the arc, combining large expulsion action with short sparkover distance for the surge.

LM

LINE MATERIAL
LIGHTNING ARRESTERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

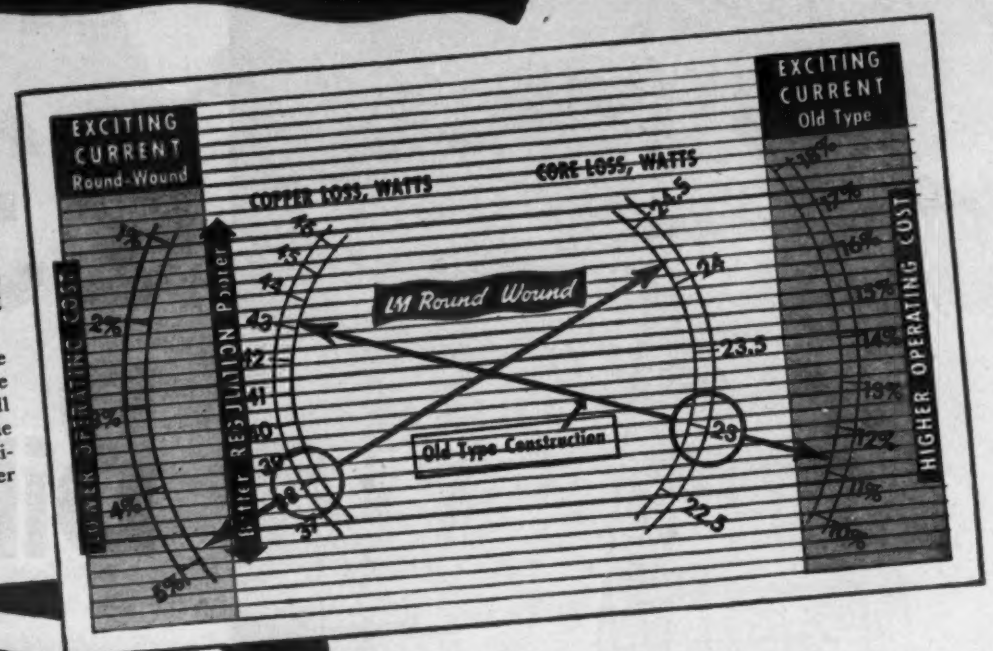
at your cake and have it, too . . . with

L-M Round-Wound Transformers

nd-Wound design offers
low operating cost *and* im-
ed regulation, instead of one
e other, or a compromise.

chart compares characteris-
of old-type conventional
nsformer design with L-M
und-Wound construction. In
-type construction (black
row), reducing the copper loss
ults in much higher exciting
rrent.

-M Round-Wound design (blue
row) makes it possible to have
better ratio of losses, and still
ave low exciting current (blue
ection); and to deliver more uni-
form voltage, securing better
revenue; and at a lower cost.



The Wound Core: wound under tension *with* the grain, in elliptical shape closely approaching the ideal magnetic circuit; then clamped and annealed; it is not disturbed, cut, or unwound after annealing. Result: no air gaps; freedom from stress; stable characteristics; low exciting current.

The Round Coils: wound directly onto completed core, by machine, assuring even tension, with no air spaces between layers; generous, undisturbed insulation; permits better ratio of losses in the direction of lower copper loss; better regulation; more uniform voltage for customers, better revenue.

How L-M Round-Wound Transformers cut costs, and still give improved regulation

Conventional distribution transformer design has always required a compromise between uniform voltage to the customer (which means higher revenue), and high cost, both for the transformer and for its operation. It couldn't give both uniform voltage and low costs.

L-M Round-Wound construction has ended these loss-juggling compromises, by permitting a better ratio of losses, with lower copper loss, and improved regulation, *without* sacrificing low exciting current and low operating costs.

The fact that L-M Round-Wound transformers offer *both*—good regulation and low costs—is due to the high efficiency resulting from the wound core and round coil construction.

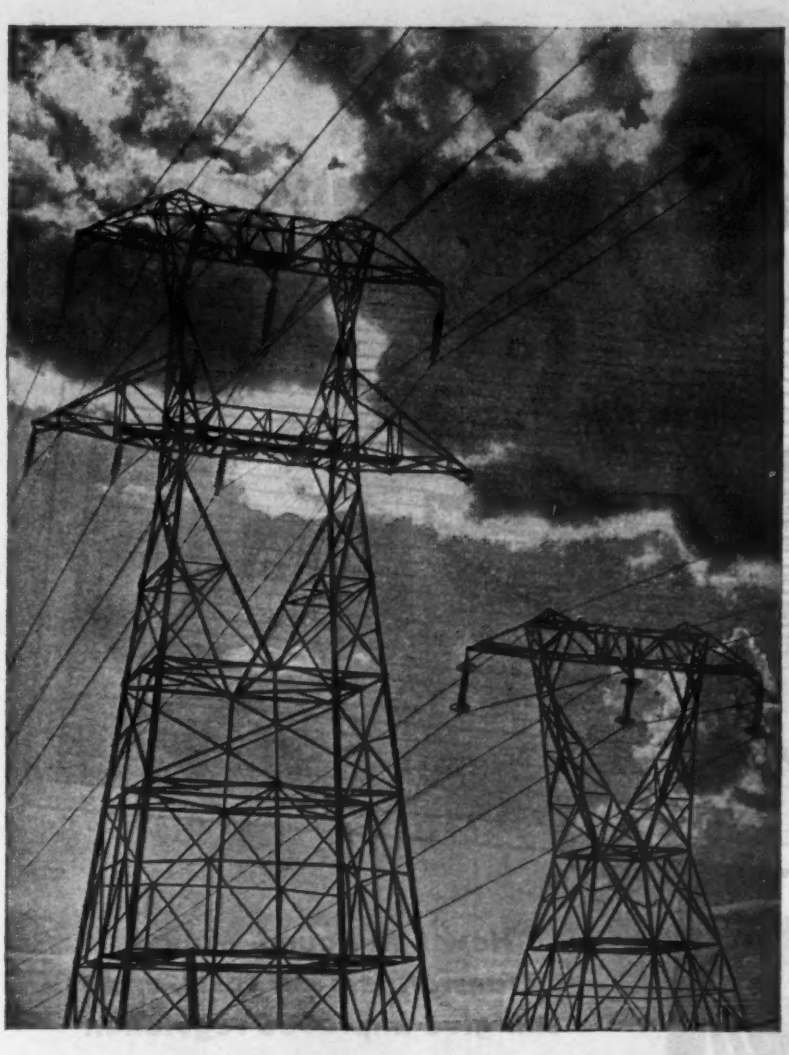
L-M transformers are available in 1½ to 25 Kva, 2400 to 7620 volts, and meet latest EEI-NEMA standards.

Ask the L-M Field Engineer for Bulletin RW-421. This bulletin illustrates and describes Round-Wound construction, and the factors contributing to its desirable characteristics. Ask the L-M Field Engineer for a copy; or call or write the nearest L-M Branch, or Line Material Company, Milwaukee 1, Wisconsin.

LM

LINE MATERIAL
TRANSFORMERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters · Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment



231 Billion kwh

ELECTRIC utility output — now totals about 231,000,000,000 kwh annually. To meet this record-breaking demand, existing power-generating equipment must operate at maximum capacity for longer periods than ever before.

Power plant operators, faced with this increased load, know that dependable, trouble-free turbine operation — in both steam and hydro plants — can best be assured by using *effective* lubricants. For this reason, they prefer *Texaco Regal Oils (R & O)*—specifically designed for turbine use.

Texaco Regal Oils (R & O), available for every type of turbine, are scientifically designed to prevent rusting of turbine lubricating systems. They are highly resistant to oxidation, foaming, sludging and gum formation. Because of these qualities, *Texaco Regal Oils (R & O)* keep turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. They fully meet specifications of all leading turbine builders and the turbine oil specificatons of the U. S. Navy.

Texaco lubricants have proved so effective in service they are definitely preferred in many fields, a few of which are listed at the right.

For suggestions on the proper care of oil and maintenance of turbine systems, call on Texaco Lubrication Engineering Service, available through more than 2300 Texaco distributing plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ *More locomotives and railroad cars in the U.S. are lubricated with Texaco than with any other brand.*

★ *More revenue airline miles in the U.S. are flown with Texaco than with any other brand.*

★ *More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.*

★ *More stationary Diesel horsepower in the U.S. is lubricated with Texaco than with any other brand.*

★ *More Diesel horsepower on streamlined trains in the U.S. is lubricated with Texaco than with all other brands combined.*

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT — CBS

"Hair Trigger" accuracy of PANELYTE* PRECISION-FABRICATION SHOWN IN HAMILTON PROPELLER BLOCKS!

Final inspection — Micrometer indicators used to determine accuracy of machining of PANELYTE Barrel Support Block to assure exact tolerances.

Vertical milling of 3" and ¾" radii on PANELYTE Barrel Support Block, milled to tolerance of ±.001" as curved surface must exactly fit inside contour of barrel.

The straight-line mass production of PANELYTE Barrel Support Blocks demands no less than 12 different machining operations. Manufactured for the Hamilton Standard Propeller for bomber and combat planes, this intricate part aligns and supports the controllable pitch mechanism, in relation to the housing. The slightest variation in any machining operation would result in faulty propeller performance.

Grinding, sanding, drilling, counterboring, and various kinds of milling are among the operations in the precision-fabrication of these PANELYTE Blocks. Three decimal tolerances are maintained on all critical dimensions. Ample facilities permit rapid mass production of this and other equally complex and essential structural parts.

Why not take advantage of the extensive, first-hand experience of the Panelyte Engineering Staff in designing, developing and producing fabricated and molded structural parts?

Barrel Support Block of fabric base PANELYTE — Note complex design of part, 3 different size holes, and milled seat and milled oil groove.

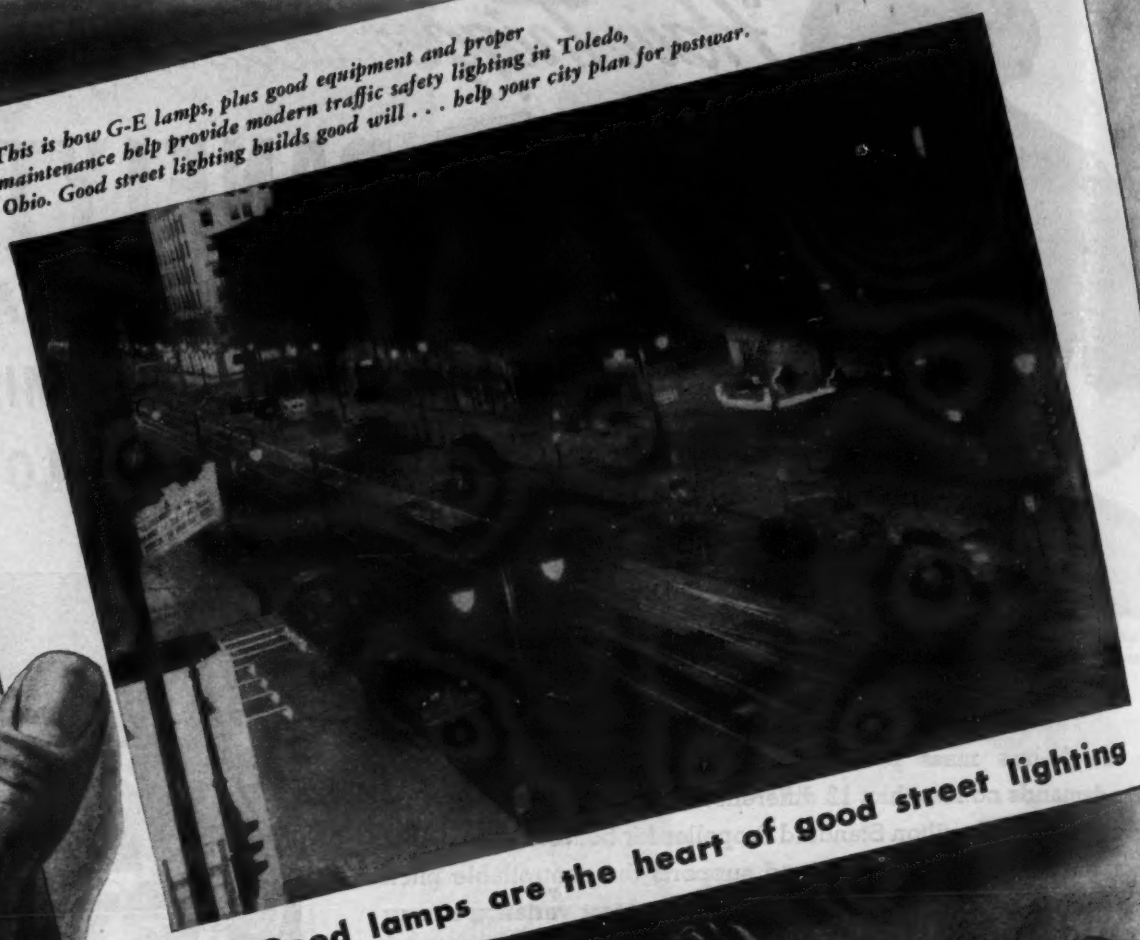
PANELYTE — *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Mexico City, Montreal, New Orleans, Phoenix, Portland, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS IN PAPER, FABRIC, FIBRE GLASS, WOOD VENEER AND ASBESTOS BASE LAMINATES

This is how G-E lamps, plus good equipment and proper maintenance help provide modern traffic safety lighting in Toledo, Ohio. Good street lighting builds good will . . . help your city plan for postwar.



. . . Good lamps are the heart of good street lighting

G-E offers 5 big advantages!

1. All the latest developments of G-E Lamp Research.
2. Lower and lower prices—50% less over last ten years.
3. G-E field engineers to work with you—help you give the public better seeing per dollar spent on street lighting.
4. More than 480 tests to assure high quality in G-E Mazda lamps.
5. Complete line readily available through nationwide G-E stocks.

THE AIM OF G-E LAMP RESEARCH IS ALWAYS TO MAKE G-E LAMPS *Stay Brighter Longer*

G-E MAZDA LAMPS

GENERAL ELECTRIC

BUY WAR BONDS AND HOLD THEM

Hear the G-E radio programs: "The G-E All-Girl Orchestra," Sunday 10 p. m. EWT, NBC; "The World Today" news, Monday through Friday 8:45 p. m. EWT, CBS; "The G-E Houseparty," Monday through Friday 4:30 p. m. EWT, CBS.

DON'T LET *Oxidation* BOOST YOUR OPERATING COSTS!

Ionization damage on paper tapes, standard model VS Type CB model

TYPE CB (CARBON BLACK) CABLE

HIGHLY ADSORBENT carbon-black paper in Type CB Cable effectively blocks the oxidation associated with ordinary oil-impregnated paper cables.

This *special* carbon-black paper actually purifies the oil—adsorbs oxidation products caused by heat, electrical stress. Naturally this construction assures longer cable life, more value for your cable dollar.

Ionization discharges are reduced, virtually preventing dendrites and wax formation in the cable. There is a definite over-all increase in cable stability.

There has not been a single report of electrical failure in any Type CB Cable in service. Ask to see graphic demonstrations of its all-round efficiency.

ANACONDA

Anaconda Wire & Cable Co.

GENERAL OFFICES: 25 Broadway, New York City 4 — *Subsidiary of Anaconda Copper Mining Company*

CHICAGO OFFICE: 20 North Wacker Drive 6 • Sales Offices in Principal Cities

KEARNEY · HI-LINE · TOOLS FOR *Safety and*

The New Kearney Con-Nec-Tap Clamp Has Protected Threads for Easier Operation

1. Screw travels into sealed, waterproof chamber containing corrosive resistant lubricant. Assures clean threads for easy removal at any time and is a guarantee against clamp freezing on the line.

2. Heavy radius contact jaws provide a bell-mouth grip to prevent damage to conductor at the clamp due to line vibration.

3. Spring lock washer prevents clamp loosening from vibration and is powerful enough to take up any expansion of parts due to temperature changes or adjustment of conductor strands which may occur after installation.

On new construction or replacement work, this new Kearney Clamp will reduce your maintenance costs — easily installed with all standard eye Clamp Sticks.

The new Kearney protected-thread Con-Nec-Tap Clamp has been designed to offer a combination of advantages available for the first time in any clamp at a price comparable with conventional clamps in the same size range.

JAMES R. KEARNEY CORPORATION

OVERHEAD UTILITY EQUIPMENT UNDERGROUND

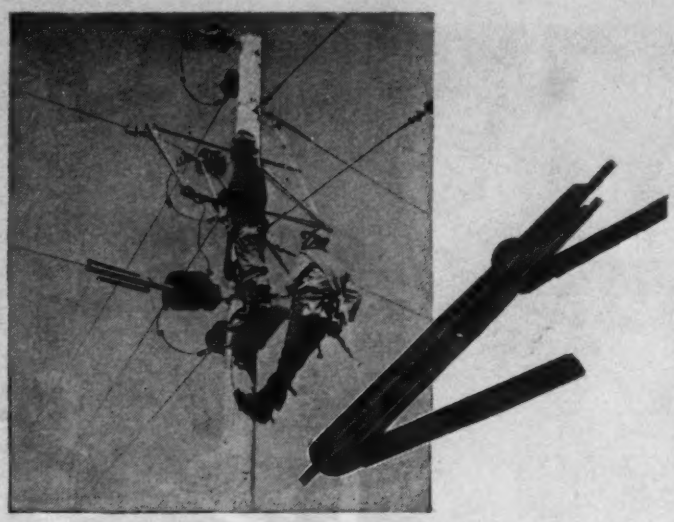
ARE DESIGNED

Convenience in Hot-Line Work!

KEARNEY HI-LINE JUMPER CLAMP WITH BUILT-IN LOAD PICKUP ELIMINATES THE DANGER OF BURNT CONDUCTORS DUE TO ARCING

The copper-rod pickup contact snaps securely into a spring contact in the line terminal by releasing bakelite sleeve grip on the handle after connection to the conductor has been made with the clamp at top. Point of contact is safely confined within the bakelite handle which has passed a minimum oil-immersion dielectric strength-test of 600 volts per mil. The clamp is built to carry 200 amperes without excessive heating.

There is an adjustable rubber guard on the handle to protect hands from accidental contact with conductor. A rubber cap on the head is provided for additional safety. Rubber gloves are recommended with this, as well as all other jumper clamps.



KEARNEY TEST FUSE HOLDERS

The Kearney Test Fuse Holder consists of standard Trip-O-Link Switch contacts attached to an insulating wood pole tested to 75,000 volts per foot.

Spring Type Con-Nec-Tap Clamp on upper member and eye at lower end to fit all standard Eye Clamp Sticks permits quick and easy installation. Arm on lower contact member is built to receive tap-off clamp from branch line.

The Kearney Test Fuse Holder is available in various lengths with a heavier spring type clamp — also with a cable lead and spring clamp attached to lower terminal.

KEARNEY SAFETY LINE GUARDS AND INSULATOR HOODS

These guards and insulator hoods protect your linemen against unnecessary pole hazards, thus expediting hot-line work through greater freedom of movement.

The line guards consist of two concentric bakelite cylinders insulated to handle as high as 23KV. Guard slips over line as shown in the illustration. A twist of the handles in opposite directions turns the cylinders so that their respective slots are opposite each other, thus locking them securely over the line and fully surrounding the conductor. Handles may be folded against guard to provide clearance.

An insulator hood of bakelite covers all insulators up to 23KV. Rope on top facilitates installation with han-pol, tie stick or other tool. Slots are provided to clear power leads. End openings fasten over the line guards to avoid separation while in use.

KEARNEY SIMPLE TO OPERATE SAF-T-HOOK CLAMP STICK

For use on the new protected thread Con-Nec-Tap Clamp and all other eye-screw type clamps.

For simple operation the Kearney Saf-T-Hook Stick has a pump-action grip with Saf-T-Lock thumb screw for positioning the clamp rigidly in the head.

It is available in various length Douglas Fir Poles tested to withstand 75,000 volts per foot for 5 minutes. Handle can't unlock accidentally due to the barrier below the operating collar. Barrier at top of operating collar protects hands during operation.

"Partners"

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO

Partial List of Kearney Tools

- TRANSFORMER HOISTS
- LEVER CUTTERS
- DEAD END TOOLS
- PLATFORMS
- CUM-A-LONGS
- TIE STICKS
- LIFT POLES & SUPPORTS
- JUMPER CLAMPS
- GROUNDING EQUIPMENT
- DISCONNECT STICKS
- SPRING TYPE HOT LINE CLAMPS
- TRUSS PIN WRENCHES & SOCKETS

4224-42 CLAYTON AVE. ST. LOUIS 10, MO.

CANADIAN PLANT • LEASIDE, ONTARIO

ENDURANCE

Here the relative time-resistances of various braids, of saturants and of insulations are tested against the destructive influence of ultra-violet light, high temperatures, and simulated wind and rain.

IN COVERINGS

For every braid or wrapping:— constant Research-testing for all possible securities of service.

General Cable's research program recognizes no *minor* problems of conductors, insulations, or of coverings. The abrasion hazards in the winding of motor armatures, the longevity of pole line installations, the cutting down of friction in pulling-in building wires—all of these and a host of other problems are subjected to searching scrutiny. For the testing of the textile yarns as raw materials, at various stages of manufacture and in the finished product, specialized practice is employed, using the most sensitive equipment that engineering brains can devise.

GENERAL CABLE CORPORATION

Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

BOILER BUSINESS placed in

Reveals widespread preference for C-E Equipment

DURING the first three months of this year, many leading industrials and utilities placed orders for new steam generating units. Their conclusions as to present-day values offered by the principal boiler manufacturers are revealed in the fact that a far larger volume of this first quarter's business was placed with Combustion Engineering than with any other company in the field. Equally significant is the fact that this preference for "C-E engineered" equipment extended through virtually the entire range of steam generating conditions:

CAPACITIES from 15,000 to 600,000 lb of steam per hr.

DESIGN PRESSURES from 160 to 1475 lb per sq in.

TOTAL STEAM TEMPERATURES from saturated at 160 lb pressure to 935 F.

Other indications of the comprehensiveness of this work are:

FUELS AND FIRING — Bituminous coal as supplied from all principal mining areas, anthracite, oil, gas, bagasse, wood refuse, soda tar and acid sludge. Pulverized coal and three types of stokers are represented in the coal-fired group which comprises slightly more than half the number of units. Combination firing of pulverized coal, oil and gas is employed in one unit, and three units are designed to burn both oil and gas.

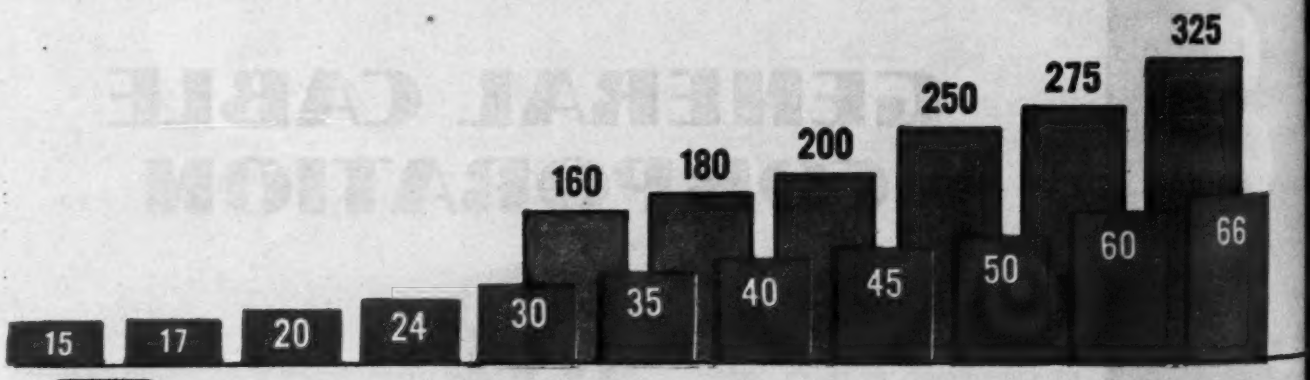
GEOGRAPHICAL — Units will be installed in the following states: Conn., N. Y., N. J., Pa., Md., Va., N. C., Fla., Ind., Ill., Mich., Wis., Minn., Mo., Kan., Ark., Colo. and Tex.; also in five Latin American countries.

INDUSTRIES — Public utility power plants, munitions, rubber, petroleum, chemicals, paper, textile, food products, sugar, tobacco and miscellaneous manufacturing.

★ ★ ★

The conclusion to be reached from all of this is that if you want the equipment comprising your next boiler unit to reflect the broadest present-day experience with fuels and operating conditions and to embody those design and construction features that are finding the widest acceptance in the field — *buy a C-E Unit.*

A-87N

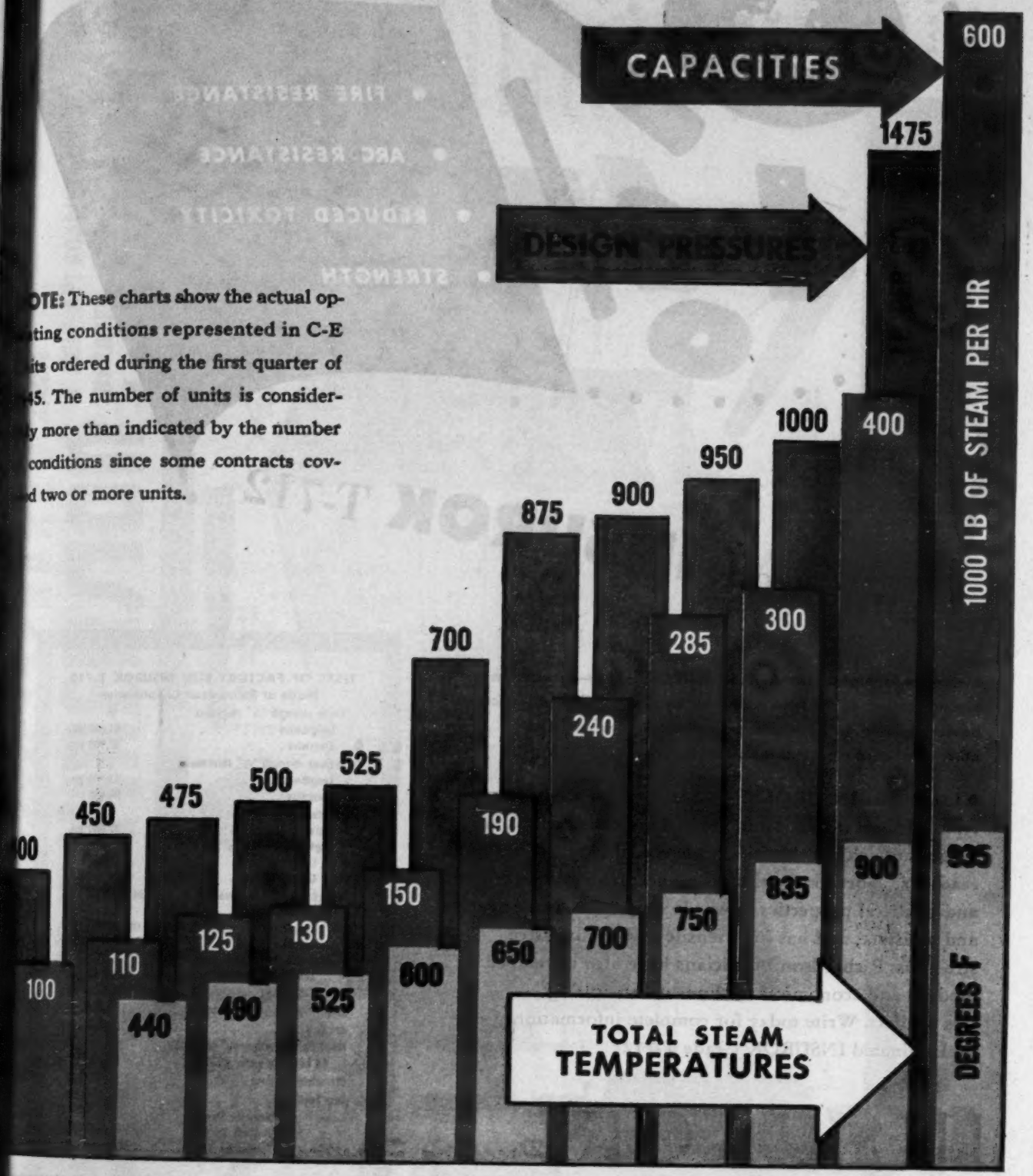


C·E

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEA

IRST QUARTER of 1945



OTE: These charts show the actual op- ting conditions represented in C-E its ordered during the first quarter of 45. The number of units is consider- y more than indicated by the number conditions since some contracts cov- d two or more units.

NGINEERING

00 Madison Avenue New York 16, N. Y.

Laminated INSUROK T-712

Melamine Fiberglass Laminate—INSUROK T-712—is a brown plastic product of the type requested by the Navy for all electrical power, lighting, interior communications, fire control and other shipboard electrical installations.

• Laminated INSUROK T-712 is superior to many other types of sheet insulation in fire and arc resistance. It has reduced toxicity in the case of unavoidable fires; does not readily support combustion; is higher in mechanical and electrical properties; lower in expansion under heat and moisture, and has high tensile and compressive strengths. Richardson Plasticians have also developed modern and economical methods of fabricating this product. Write today for complete information on Laminated INSUROK Grade T-712!

TESTS OF FACTORY-RUN INSUROK T-712
Made at Richardson Laboratories

Tensile strength ⅛" thickness	
Lengthwise	45,600 psi.
Crosswise	37,900 psi.
Flexural strength ⅛" thickness	
Lengthwise	53,700 psi.
Crosswise	50,400 psi.
Compressive strength	
Flatwise (½"x½"x½")	97,800 psi.
Edgewise (½"x½"x½")	
Lengthwise	29,460 psi.
Crosswise	24,600 psi.
Impact strength Izod method per inch of notch	
Flatwise (½"x¼")	
Lengthwise	Greater than 23 ft. lbs.
Crosswise	27.4 ft. lbs.
Edgewise (½"x¼")	
Lengthwise	18.8 ft. lbs.
Crosswise	16.5 ft. lbs.
Bond strength ½" thickness	1,800 lbs.
Arc Test	185 sec.
Moisture Absorption ⅛" thickness	
24 hours in water at 77° F.	1.84%
Dielectric Constant	5.65
Loss Factor	.0521
Dielectric Strength	
Short Time	590 volts/mil
Step by Step	410 volts/mil

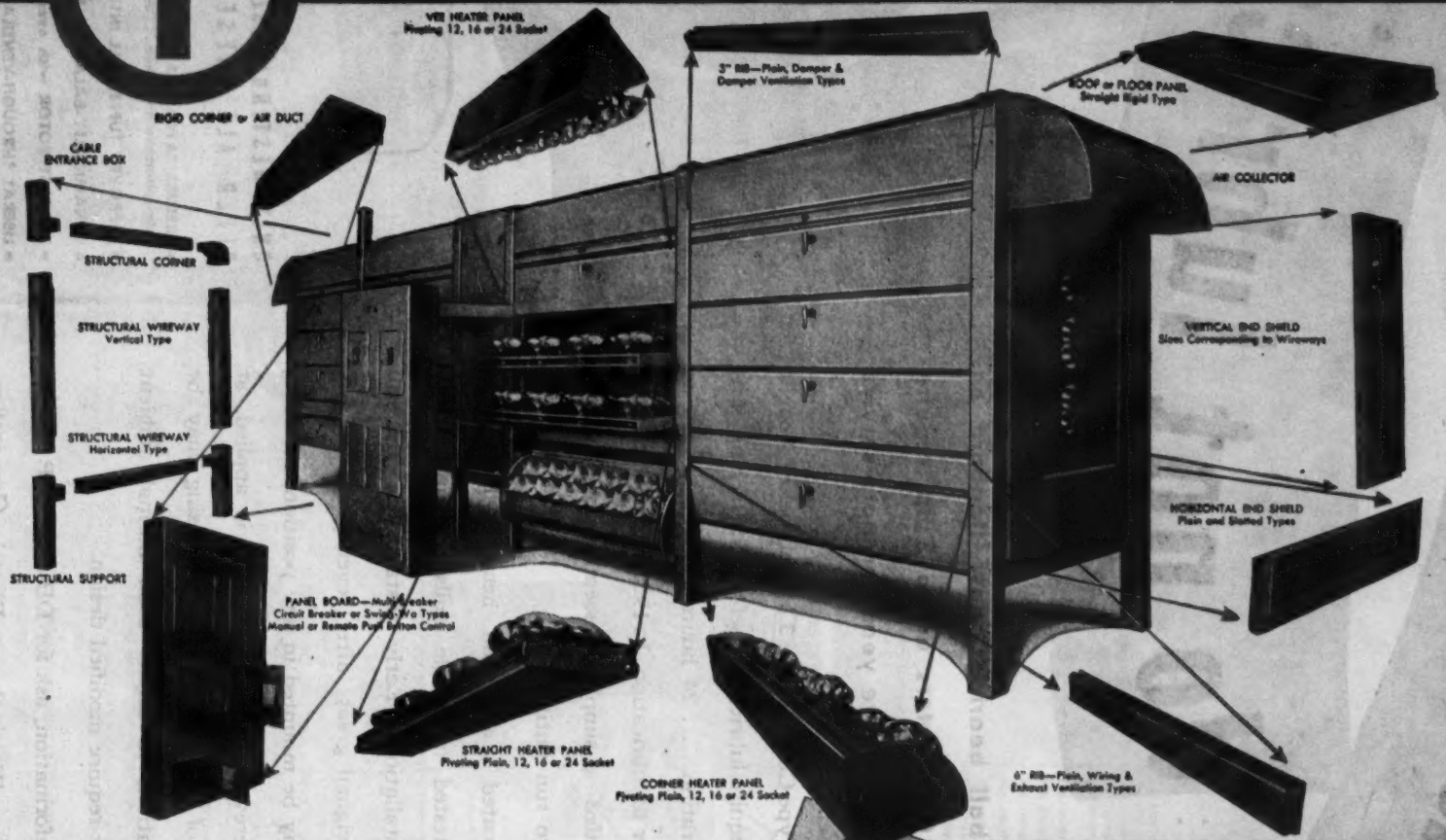
INSUROK *Precision Plastics*

The RICHARDSON COMPANY

MELROSE PARK, ILL. NEW BRUNSWICK, N. J. FOUNDED 1868 INDIANAPOLIS 1, IND. LOCKLAND (CINCINNATI 15) OHIO
DETROIT OFFICE 6-252 G. M. BUILDING, DETROIT 2, MICHIGAN NEW YORK OFFICE 75 WEST STREET, NEW YORK 6, N. Y.
CLEVELAND OFFICE 326-7 PLYMOUTH BLDG. CLEVELAND 15, OHIO

TRUMBULL *standardizes* INFRARED *with* RAYMERSION

A *NEW* APPROACH TO THE EFFICIENT USE OF INFRARED . . . TODAY'S ACCEPTED STANDARD IN LOW TEMPERATURE INDUSTRIAL HEATING



Trumbull "Raymersion" Ovens assure full and uniform immersion in infrared radiation and circulating convection heat. Controlled exhaust or recirculation overcomes stratification, utilizes all by-product losses from infrared and heated product. Work of any size, shape or mass may be handled at lowest costs and in minimum time.

THE TRUMBULL ELECTRIC MFG. CO.
Plainville, Conn.
—
Norwood, Ohio

Send for Bulletin No. 500

ANY SIZE ANY PRODUCTION
ANY HEAT CAPACITY
ANY HANDLING METHOD

OTHER FACTORIES
SAN FRANCISCO
SEATTLE
LOS ANGELES

Install in 1945 ... do not lubricate

Prelubricated ball bearings, now standard on Westinghouse CSP Motors up to 3 hp, require lubrication only after five years' or more service

Westinghouse Type CSP Motors, 3 hp and below, bought in 1945, will not require lubrication before 1950. Think of it! Five years of operation . . . 24 hours a day . . . with no attention whatever to lubrication. In 1950, inspect bearings. If greasing is needed—a simple disassembly job—and the motor is all set to run until 1955.

These prelubricated sealed ball bearings have been thoroughly field-tested in textile mills and in built-in machine tool installations. Early installations are still running on the original grease after seven years' service.

CSP motors may be mounted in any position, including the vertical. Wherever Class A insulation is applied, at least five years of operation without greasing may be expected. Applications in higher than normal ambient temperatures may require modified design.

For complete information, ask for DB-3100-CSP at your Westinghouse office. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21326

ONLY WESTINGHOUSE CSP MOTORS OFFER ALL THESE ADVANTAGES

- PRELUBRICATED SEALED BALL BEARINGS reduce lubrication maintenance . . . assure longer grease life.
- IMPROVED TUFFERMILL INSULATION.
- DYNAMICALLY-BALANCED ROTOR.
- DIE-CAST ROTOR with [illegible].
- LIBERAL THROUGH-VENTILATION—air enters front louvres at drive-end of motor.

This label appears on the end bracket of every CSP motor up to frame 225. It is your assurance of smooth operation, long bearing life, and low maintenance. It also means:

- No overgreasing.
- No grease seepage into windings.
- No unreplaced plugs.
- No costly lubricating schedules.
- No grease contamination.
- No "skipped" bearings while greasing.

HOW IT WORKS

High-grade, long-life grease, specifically designed for these bearings, is packed into the bearing assembly by the bearing manufacturer. This original grease is good for at least five years of normal service. Double-width, single-row construction permits a more liberal grease supply and better sealing than the single-width design. Two seal discs, locked into the outer race by snap rings, fit closely over the inner race to form a revolving seal.

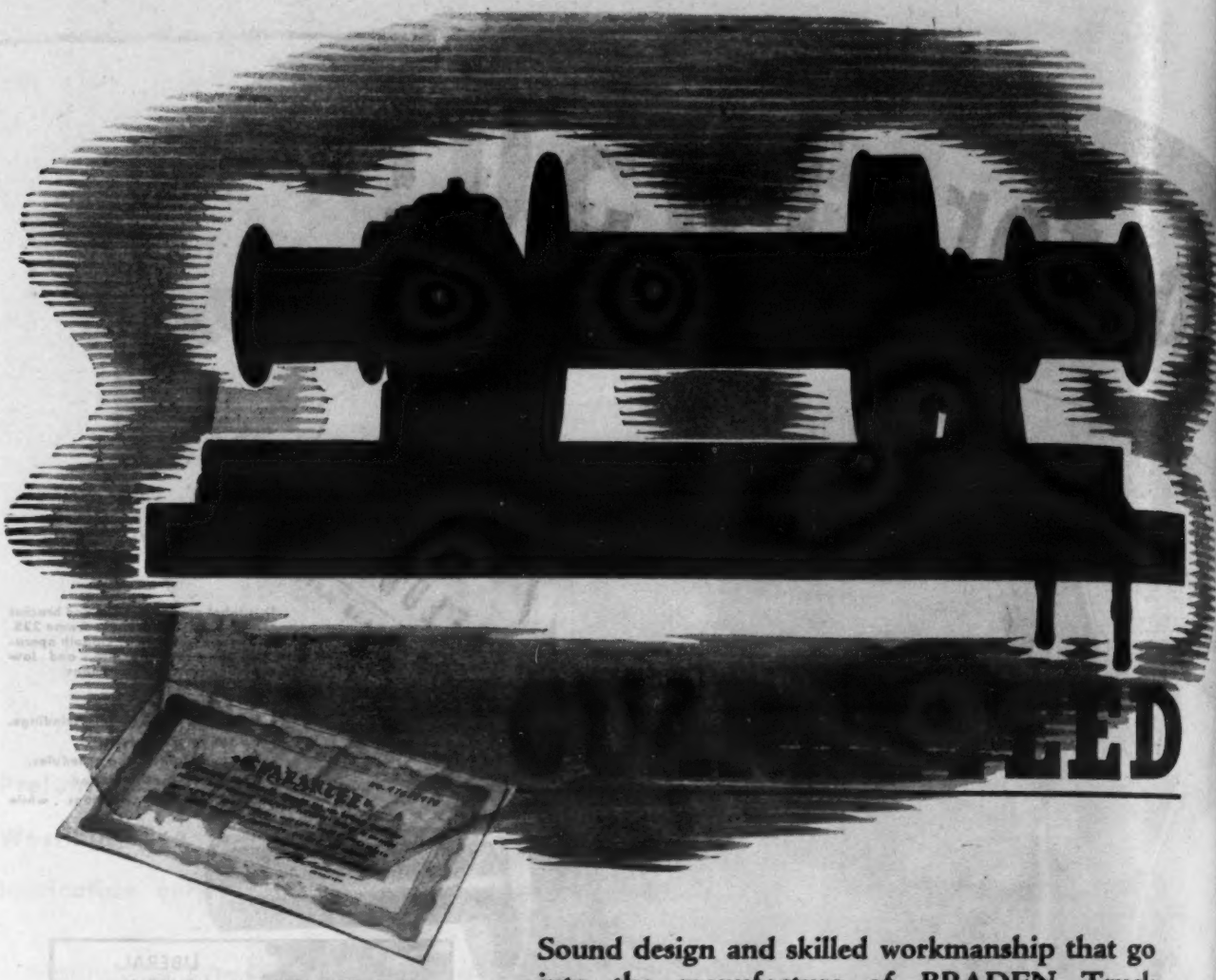
When motor is disassembled for other reasons, this construction keeps dirt out of bearings just as effectively as the cartridge bearings now in common use.

WESTINGHOUSE

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

TYPE CSP MOTORS



Model M6-15B
(Illustrated above)

This is the *newest* winch in the BRADEN line. It has a rated capacity of 12,000 lbs., and is already a recognized leader in the power winch field.

The M6-15B is equipped with the new OIL-COOLED, FULLY ADJUSTABLE, AUTOMATIC *Safety* BRAKE which keeps a suspended load safely under control at all times.

It will pay you to specify BRADEN Winches for any handling job. See your nearest dealer or write to the factory for new catalog which will be ready soon.

Sound design and skilled workmanship that go into the manufacture of BRADEN Truck Winches, combined with especially selected materials, make it possible to guarantee every winch that leaves the factory. The Braden Winch Company registers every winch manufactured by them, and guarantees it to the original purchaser against defects in workmanship and materials, for a period of one year from date of purchase. Further, the worm gear is guaranteed against breakage through the tooth-base ring (split open), so long as the winch shall remain the property of the original owner.

"Buy BRADEN — They are SAFER"

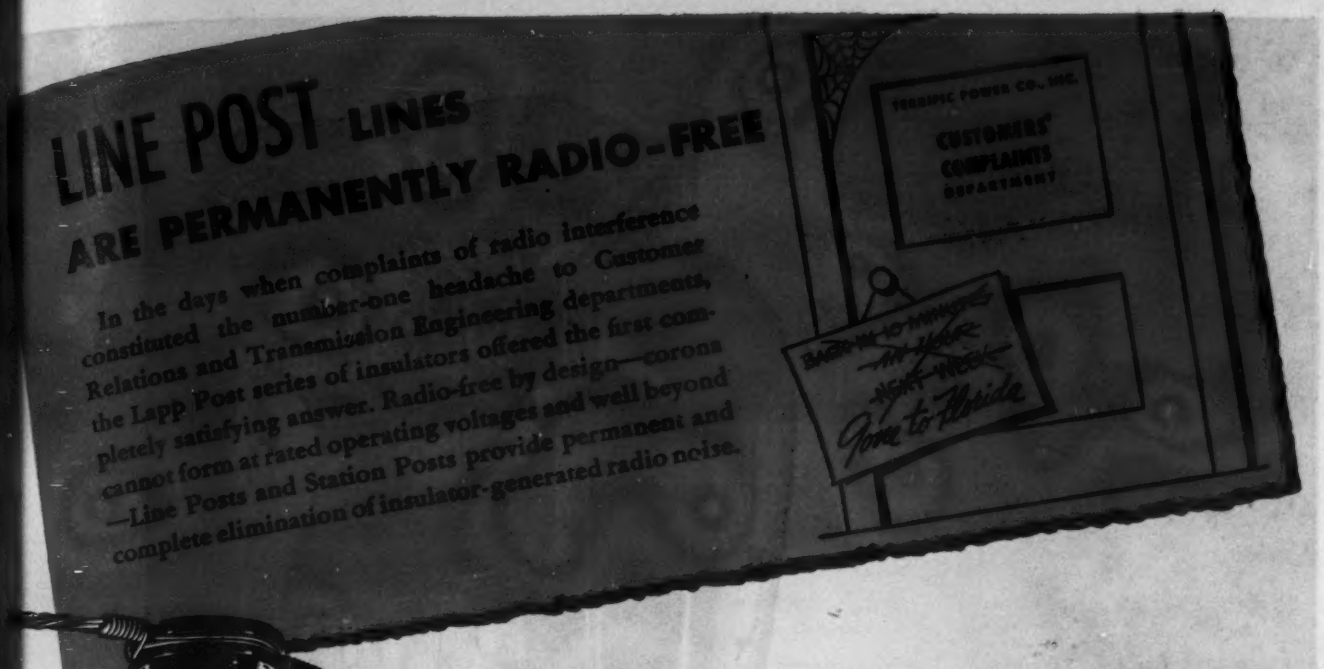
BRADEN WINCH COMPANY
1001 East Admiral Boulevard

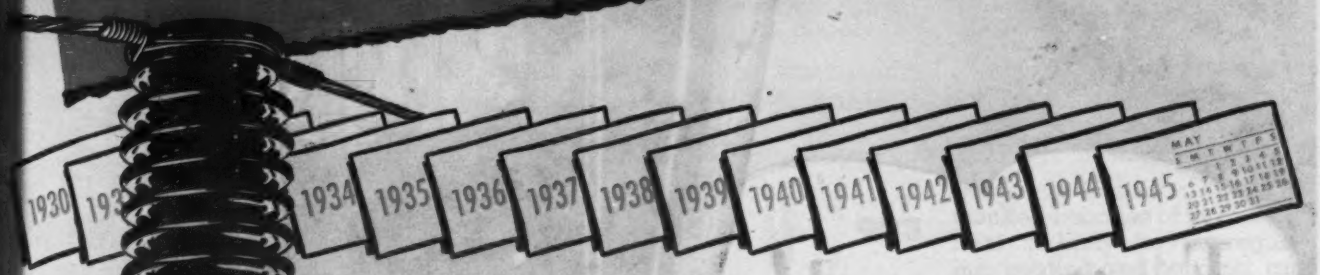
BRADEN Winches

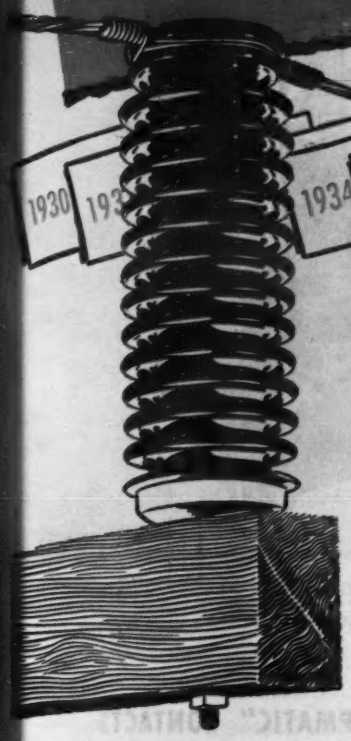
TULSA 3, Oklahoma

LINE POST LINES ARE PERMANENTLY RADIO-FREE

In the days when complaints of radio interference constituted the number-one headache to Customer Relations and Transmission Engineering departments, the Lapp Post series of insulators offered the first completely satisfying answer. Radio-free by design—corona cannot form at rated operating voltages and well beyond—Line Posts and Station Posts provide permanent and complete elimination of insulator-generated radio noise.

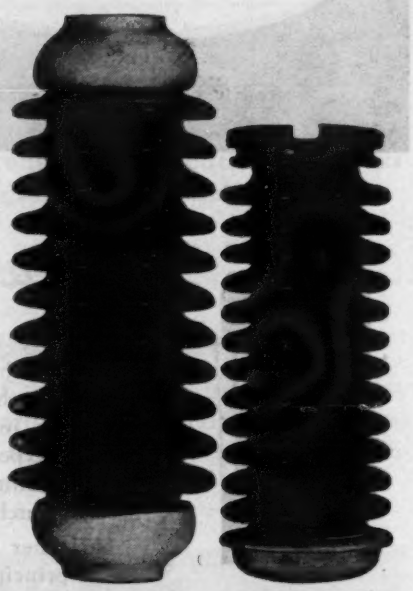






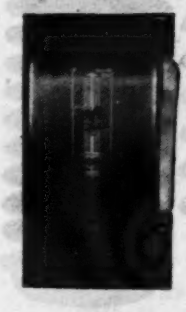
LAPP LINE POSTS HAVE A 15-YEAR SERVICE RECORD

The first shipment of Lapp Line Posts went into service 15 years ago. The installation was the one which had inspired The Line Post design—a particularly bad, and previously unsolved, dirt condition. Since then, hundreds of thousands of Lapp Posts have gone up, in many cases a desperation answer to a difficult service problem—dirt condition, mechanical attack, radio noise, arcover failure. And the 15-year service record of these insulators shows them to stand up better, with fewer line outages, and lower replacement ratio, than any other insulator now in use.



Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.



Vacu-Break

SAFETY SWITCH WITH "CLAMPMATIC" CONTACTS

BullDog technicians put in years of laboratory research to develop these advanced principles in safety switch design—more years of experimental engineering to *prove* them. Result: The BullDog Vacu-Break Safety Switch—far ahead of the field!

No other safety switch has the Vacu-Break principle of arc suffocation—Clampmatic contacts tight as a bolted connection in the *ON* position, thus reducing heating —simplified mechanism for positive operation—modern streamlined cabinet—ample interior wiring space without sacrificing over-all compactness. Capacities from 30 Amp. to 1200 Amp.

Take the word of top-flight engineers in leading plants of the nation. Or investigate for yourself. Write for illustrated folders.

BUY WAR BONDS

BULLDOG

ELECTRIC PRODUCTS COMPANY

SALVAGE PAPER

BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN. In Canada: BullDog Electric Products, Ltd., Toronto. Field Engineering Offices in All Principal Cities.

Also Manufacturers of

SafToFuse Panelboards—Switchboards—Circuit Master Breakers — BUStribution DUCT, for "plug-in" power — Universal Trol-E-Duct, for flexible lighting—Industrial Trol-E-Duct, for moving "loads."

DOW CORNING

SILICONES

DOW CORNING, first in silicones, is fully equipped with new plant and facilities for the production and distribution of an expanding line of silicone products

American industry has been quick to utilize the new Dow Corning Silicones—to see the potentialities inherent in their higher order of heat stability, chemical inertness, water resistance, and dielectric properties. Dow Corning is now supplying, directly or through selected distributors, the following silicone products:

DC FLUIDS Water-white, odorless, inert Silicone Liquids . . . notable for their low rate of viscosity change over a wide temperature range, low vapor pressure, water repellency, and good dielectric properties.

DC 993 Insulating Varnish . . . recommended because of its extreme heat stability for impregnating, coating and bonding, and waterproofing inorganic insulating materials such as asbestos, mica, and Fiberglas cloth, tape, and sleeving. Other special purpose silicone resins and compounds are available.

DC 4 Ignition Sealing Compound . . . an easily applied silicone waterproofing compound having excellent dielectric properties, corona resistance, and the consistency of petroleum jelly. It neither hardens nor melts at temperatures ranging from −40° F. to 400° F.

DC STOPCOCK GREASE A chemically resistant Silicone Grease for lubricating stopcocks and other ground glass joints.

DC 7 Special Low Temperature Compound . . . an oxidation resistant lubricant and sealing compound developed for use at temperatures as low as −70° F.

DC PLUG COCK GREASE A Silicone Grease that affords easy operation of lubricated plug valves over wide temperature ranges in most difficult services.

DC 31 A lubricating Silicone Grease for special applications in the temperature range of −70° F. to 190° F.

DC 41 A lubricating Silicone Grease for special applications where operating temperatures range from 0° F. to 400° F.

Dow Corning

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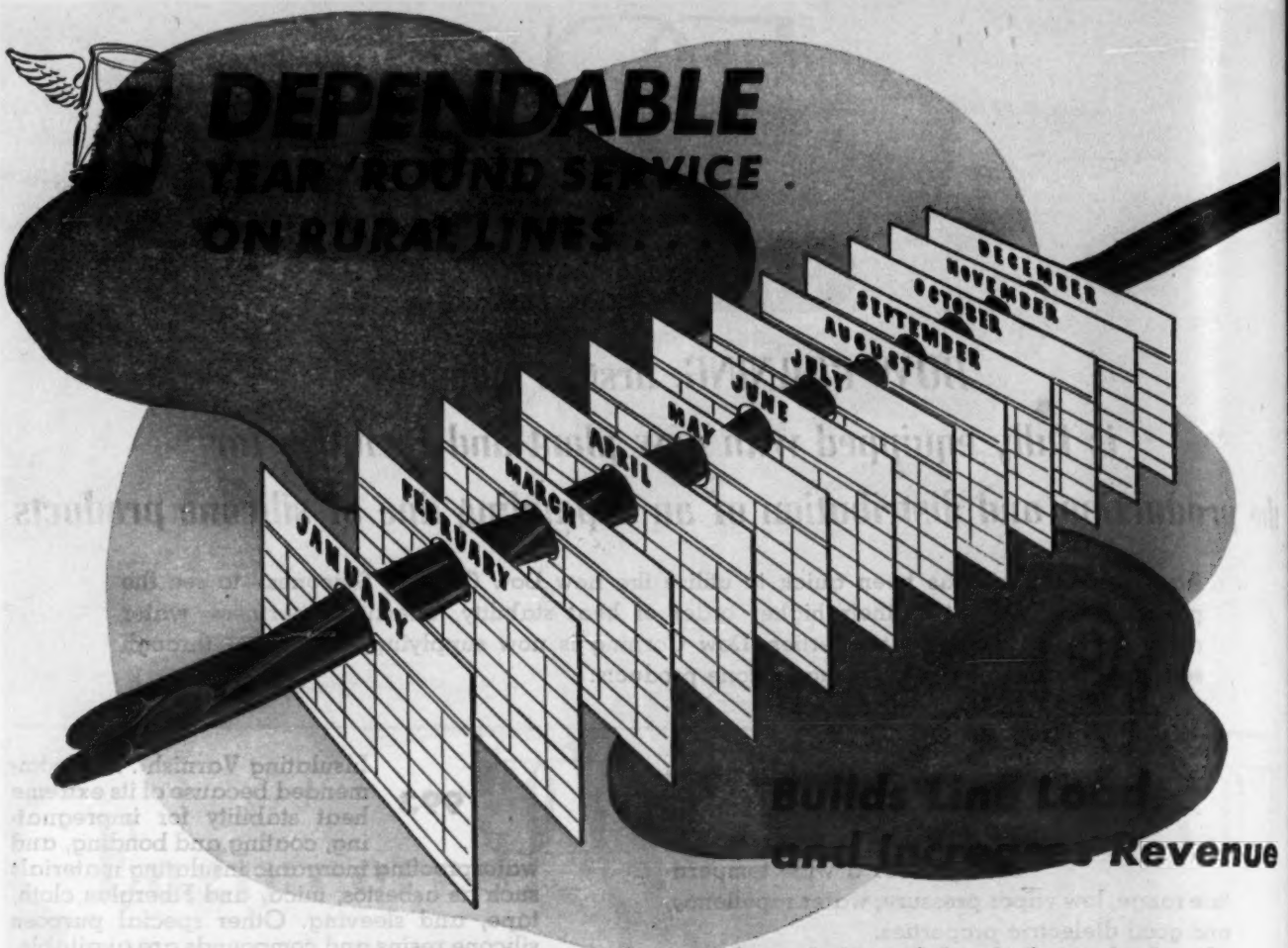
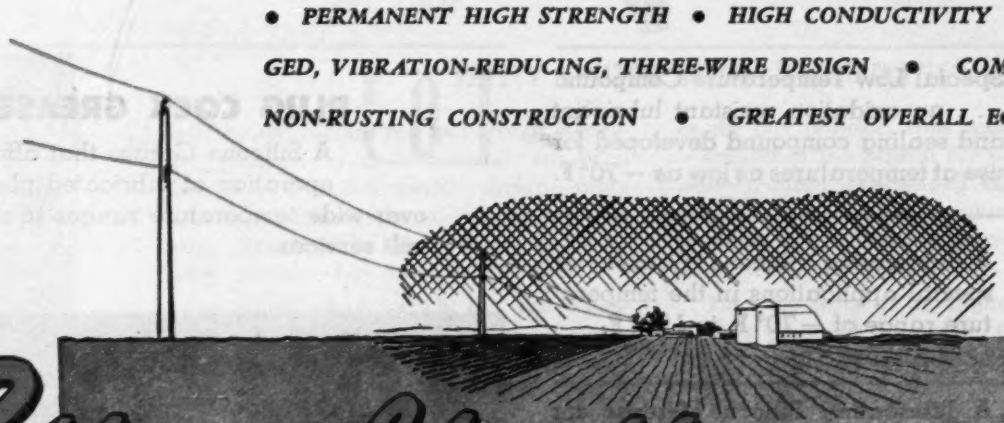


Revenue

Once the farmer gains confidence in 'round the clock continuity of electrical service his monthly bills for power grow bigger as new applications are woven into the pattern of his everyday life.

To insure the dependability which successful farm operation demands, specify Copperweld-Copper Conductors, which provide:

• *PERMANENT HIGH STRENGTH* • *HIGH CONDUCTIVITY* • *RUGGED, VIBRATION-REDUCING, THREE-WIRE DESIGN* • *COMPLETELY NON-RUSTING CONSTRUCTION* • *GREATEST OVERALL ECONOMY.*



Copperweld-copper CONDUCTORS

COPPERWELD STEEL COMPANY

ARMY E NAVY

Glassport, Pa.

IF YOU USE HOT AIR IN ANY INDUSTRIAL PROCESS

Look FURTHER into PREHEAT ENGINEERING

THE *Ljungstrom* AIR PREHEATER

The Ljungstrom operates on the continuous, regenerative, counterflow principle. As hot gases pass through the heating section of the unit, metal elements of the rotor soak up the heat then rotate into another section, sealed from the first, where this heat is transferred to the air or gas to be heated.

In addition to its contribution to higher heat recovery in steam generation, the Ljungstrom Air Preheater has other important industrial applications. If your process requires, or can use to advantage, preheated air or gas up to 1,400 deg. F., it will pay you to investigate the possibilities of the Ljungstrom.

Today, preheat engineering is improving copper smelting, aiding operation of waste disposal plants, lowering the cost of production of synthetic rubber. Chemical and metallurgical industries are exploring its potentialities as applied to all their processes employing heated air or other heated gases. Dehydrating plants, too, are looking further into its possibilities.

ENGINEERING SERVICE

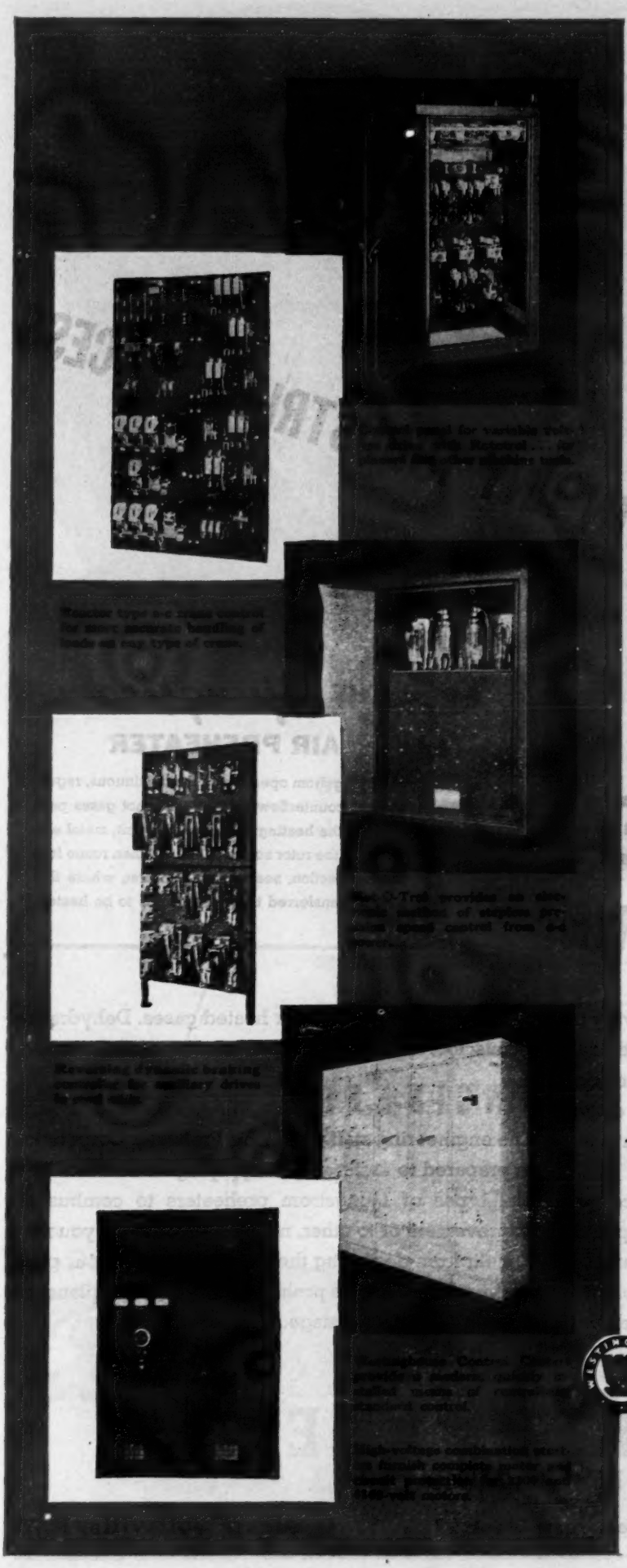
The engineering staff of The Air Preheater Corporation is prepared to assist you in applying standard or special types of Ljungstrom preheaters to combustion improvement or to other, newer, uses. So that you may benefit from designing the Ljungstrom into your plant or process, call in the preheat engineer while plans are still in the formative stage.

THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.



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Control properly selected and applied makes it easy to put motors through their paces . . . to stand up and deliver. Application of control can be greatly simplified also by making one supplier responsible for the entire motor drive.

Westinghouse motor control not only covers the entire range of standard a-c and d-c controls and accessories for every type of drive, but many specialized types of control like those shown at left. Regardless of the job, you are assured of a completely co-ordinated installation. Call your Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

Selection of Westinghouse standard motor control is greatly simplified by this 290-page Buying Data book. If you do not have a copy, phone or write your Westinghouse office for Catalog 7000.

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Motor Control

IN THE BATTERY ROOM DEPENDABLE EXIDES ARE STANDING GUARD . . .

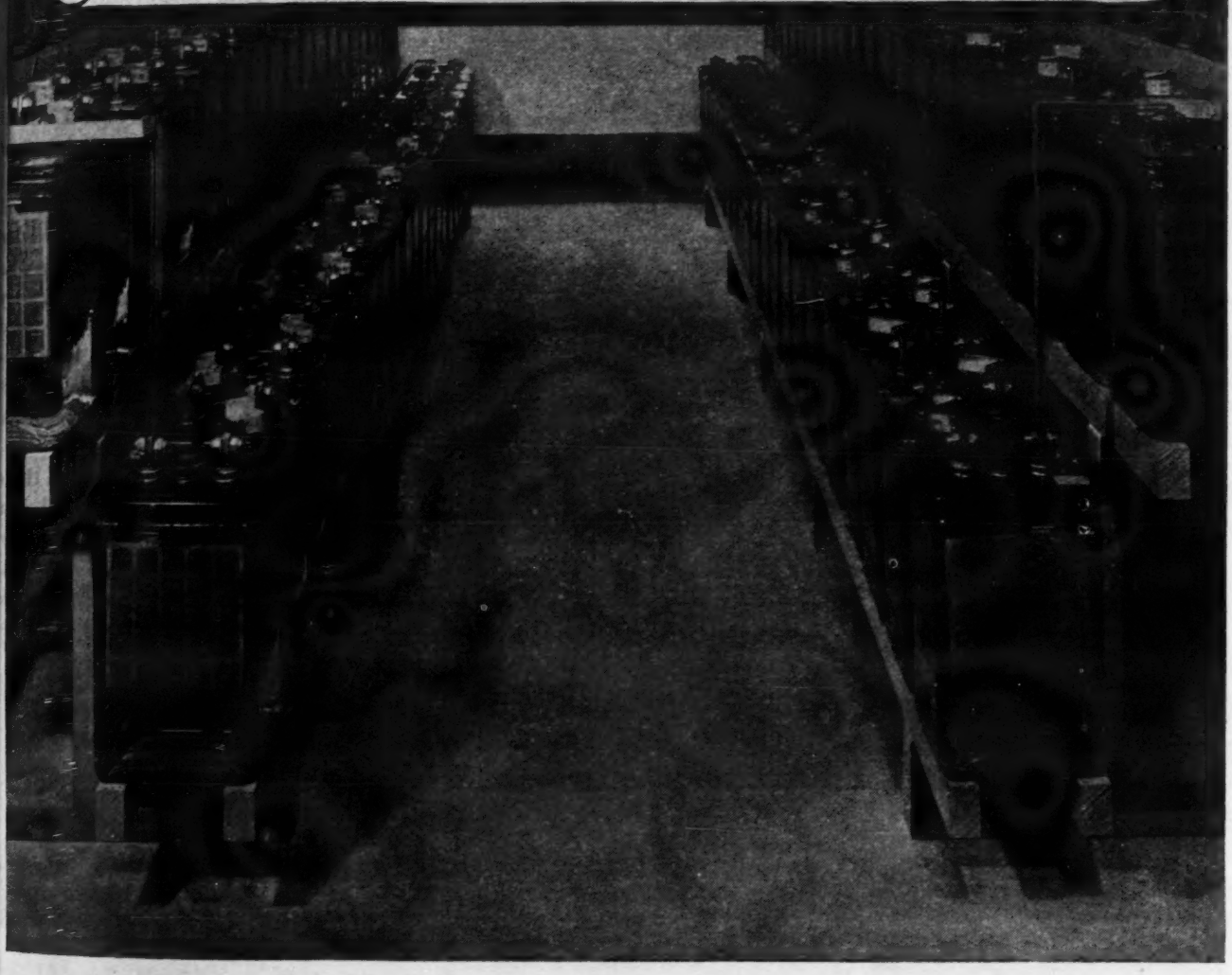
From America's Central Stations, hundreds of millions of kilowatts are generated every 24 hours . . . turning the wheels of war industry and meeting every essential consumer demand. It is a noteworthy accomplishment, even when measured by the other impressive achievements of these record-making days. In the battery rooms of a large percentage of these stations, Exide Batteries are on control bus duty, ready to respond promptly and powerfully whenever needed.

Exide makes several types of storage batteries for control bus operation. These batteries have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industrial plants is proof of their dependability, long-life and ease of maintenance. When you buy an Exide, you *Buy* to *Last.*

Whatever your battery problems, Exide engineers will be glad to help you solve them.

Exide BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto



A TRACE OF Li*

and Burndy adds 20% to the strength of cast electrical CONNECTORS

Continuing its leadership in connector development, Burndy now supplies cast electrical connectors made from Burndy alloy #113L... a new high-copper alloy containing *Lithium. This important addition of Lithium, in correct amount, provides denser, finer grained castings . . . with tensile strength increased 20%, elongation increased about 20%, and coefficient of friction materially reduced.

Thus today, Burndy cast electrical connectors provide an even *greater* margin of superiority than in the past. Far stronger and tougher, they can be installed with greater applied pressure, and are more readily conformable to the conductor . . . assuring a tight, durable, full-contact-area connection.

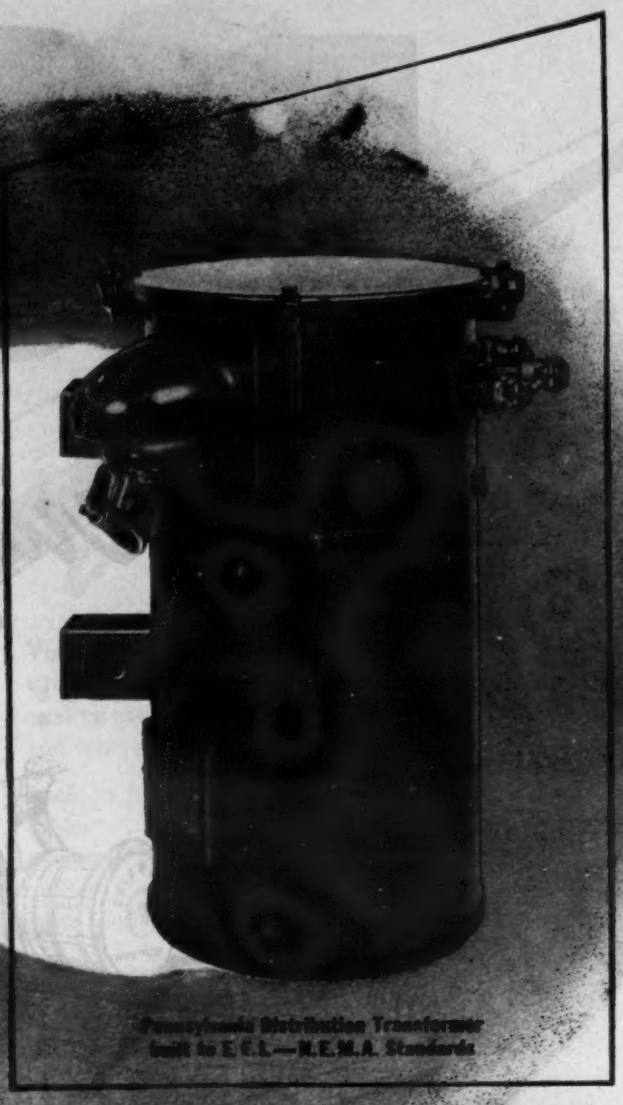
For complete information on these or any other type of electrical connectors, write connector headquarters . . . Burndy Engineering Co., Inc., 107-J Bruckner Boulevard, New York 54, N. Y.

Headquarters for CONNECTORS

Burndy

In Canada: Canadian Line Materials, Limited, Toronto 13

Every Pennsylvania Distribution Transformer gives you these electrical and mechanical advantages

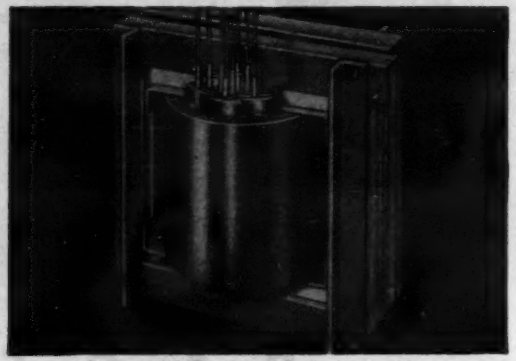


Pennsylvania Distribution Transformer built to E.E.I.—N.E.M.A. Standards

- Core is built up of individual laminations varnished on both sides. It operates at a low density which results in low exciting current at normal voltage as well as at over voltages.
- Circular Coils are wound tightly with uniform tension, eliminating possibility of stretching the wire and injuring the insulation.
- Coils are mounted concentrically on Core and held firmly in place, thus eliminating possibility of movement during transportation or in service.
- High Voltage and Low Voltage Coils are readily removable from Core as a unit, permitting minor repairs or replacement of Coils with minimum time and expense.
- Generous size of Core and Coils results in high, short-time overload capacity.

A thorough knowledge of transformer design, supplemented by a careful analysis of operating and maintenance problems, have resulted in many desirable operating features being incorporated in Pennsylvania Distribution Transformers. Some of these are listed above.

Coil mounted firmly on Core before yoke steel is built in.



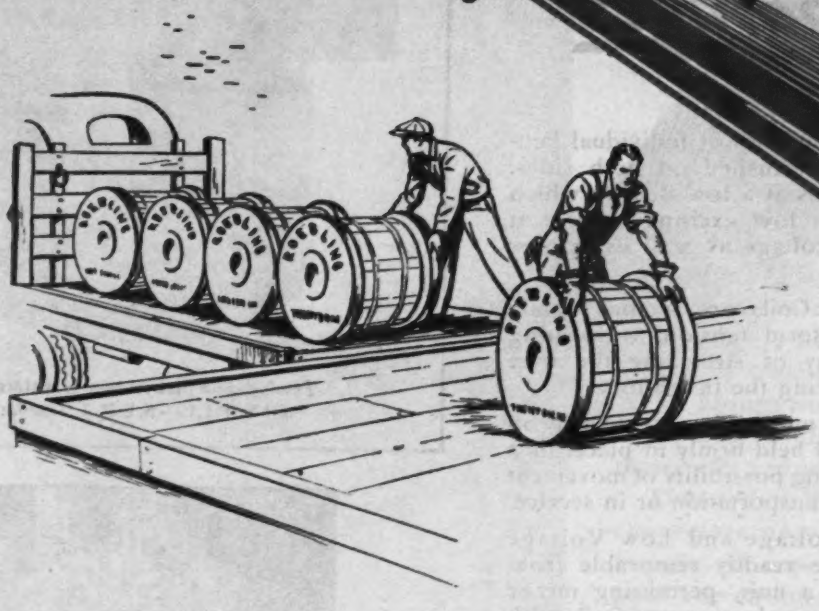
Core and Coil unit ready for assembly.

Pennsylvania TRANSFORMER COMPANY

808 RIDGE AVENUE, N. S., PITTSBURGH 12, PA.

ROEB

Delivering the goods.



AT YOUR SERVICE—ROEBLING ELECTRICAL WHOLESALERS

Typical of the electrical wholesalers who offer Roebling products are these two: W. C. Figroid, (left) Gilson Supply Co., Oakland, Calif., and E. D. Knight, Virginian Electric, Inc., Charleston, W. Va.

PACEMAKER IN

LING

that "Deliver" for you!

PRODUCING THE FINEST in electrical wires and cables — over 60 types for every purpose—is Roebling's job. From bare copper wire and strand to tough power cables . . . they're all made to the same high standards . . . to give superior performance.

And it's your Roebling electrical wholesaler who makes them available to you . . . even under today's trying conditions.

You can count on him . . . to provide a wide variety of Roebling and other quality products . . . for delivery when and where wanted . . . at a fair price.

Look to Roebling electrical wires and cables . . . and to Roebling electrical wholesalers . . . to fill your needs. Together they're at your service — for your profit!

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TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

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Weatherproof Wire · Rubber Covered Wires and Cables · Service Entrance Cables (including Thin-Wall Roeplastic Insulated Building Wires) · Rubber Sheathed Portable Cables · Rubber Insulated Power Cables · Telephone Wires · Varnished Cambric Power Cables · Magnet Wire · Bare Copper Strand · Pigtail and Braided Copper · Trolley Contact Wire.

WIRE PRODUCTS

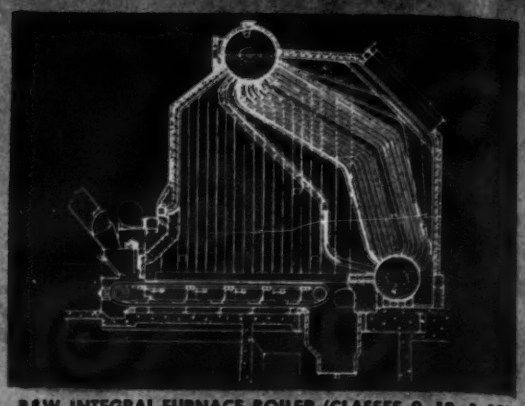
PRACTICAL PLANS for

In the wake of this war will come new jobs for steam . . . new opportunities . . . new problems . . . keener competition . . . that will put renewed emphasis on power plant reliability, efficiency, and operating costs.

When the urgency of war production begins to unwind into the pattern of peacetime competition, power plant engineers will want to be ready in advance with step-by-step plans for urgently needed modernization and expansion of existing facilities. Properly drawn, such plans will help speed reconversion of their own industries and hasten action in providing for fully integrated power services having the high overall efficiency and flexibility for changing conditions that future operations will demand.

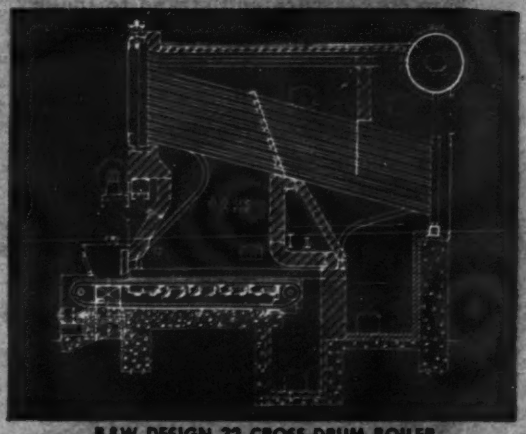
Thinking and planning for tomorrow *today* is a job B&W engineers are ready to tackle in partnership with power engineers of industry. Their long leadership in meeting steam power requirements has been greatly augmented by much more valuable experience gained in serving the industry war needs.

When the time comes to specify equipment for the future, there is a B&W boiler for any combination of conditions . . . capacity, pressure, temperature, feedwater, fuel and space . . . to be met. Whatever the type needed, it is built for the job, thus assuring the highest standards of performance, continuity of service, high overall station economy and greatest return on the investment.



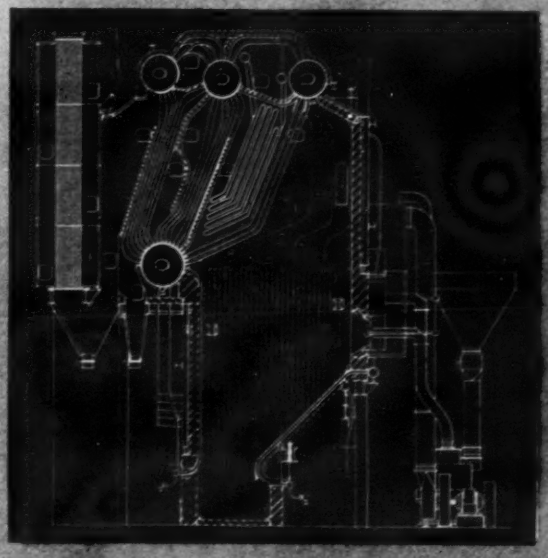
B&W INTEGRAL-FURNACE BOILER (CLASSES 9, 12, & 15)

This Integral-Furnace Boiler is available for firing with stokers or with oil, and in sizes ranging from 1353 to 6506 sq. ft. of heating surface. Having a water-cooled furnace of special design, this boiler provides the dependability of central-station boilers, with efficient and smokeless combustion.



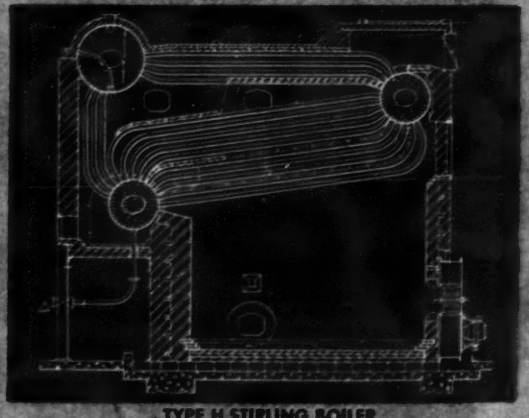
B&W DESIGN 32 CROSS-DRUM BOILER

This unit is widely used in small and medium-size power plants where refractory furnaces are suitable. It provides the advantages of the straight-tube, sectional-header construction used in B&W Cross-Drum Boilers designed for larger capacities.



STIRLING BOILER

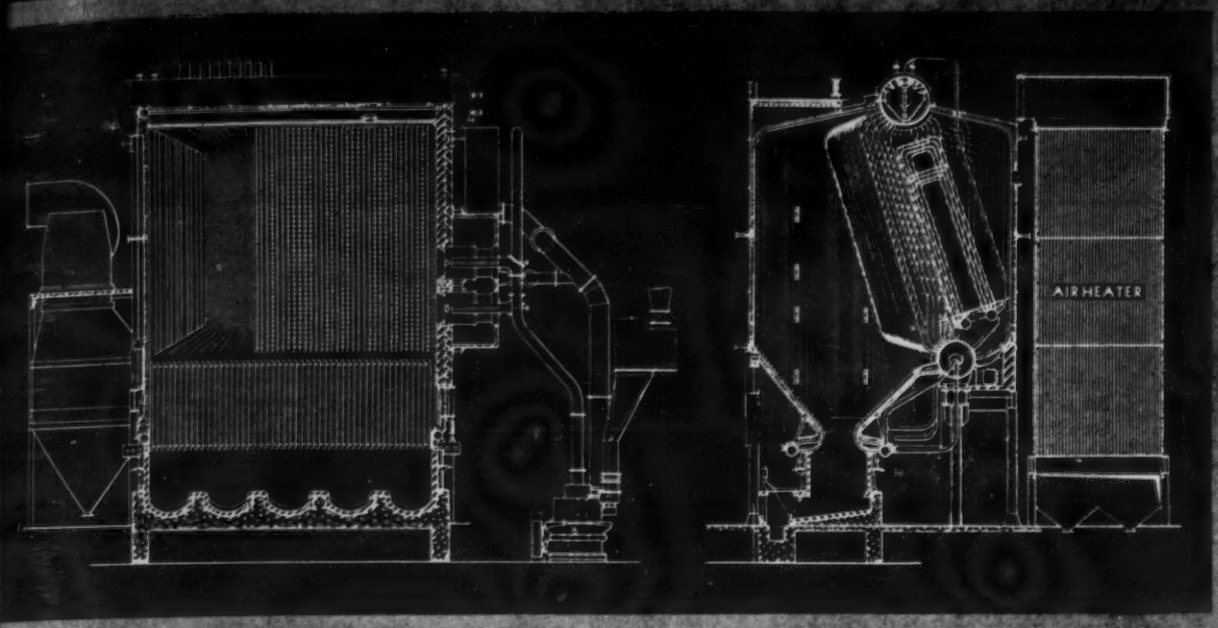
The Stirling Boiler fully meets the requirements of modern operating conditions. It readily responds to sudden and heavy demands for steam, and delivers dry steam at relatively high ratings when operated with water having a high concentration of solids. May be fired with any fuel.



TYPE H STIRLING BOILER

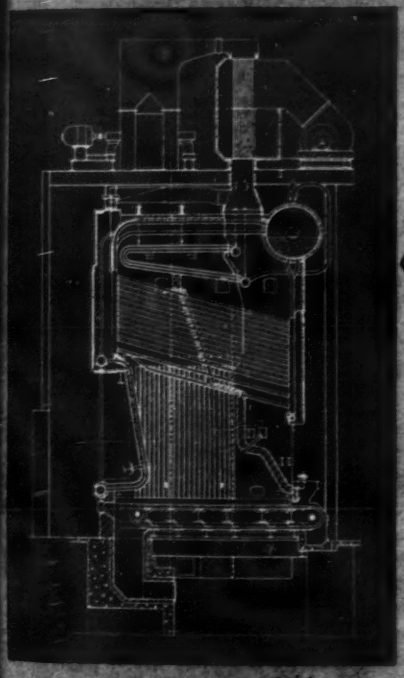
A low-head moderate-pressure unit that is widely used in small industrial plants, institutions, hotels, office buildings and to meet other similar requirements. Available in capacities ranging from 1500 to 30,000 lb. steam per hr. and for firing with any fuel. The furnace, usually of refractory, provides the necessary degree of dependability.

PEACETIME POWER . . .



INTEGRAL-FURNACE BOILER

The Integral-Furnace Boiler is a completely co-ordinated unit built in capacities up to 250,000 lb. steam per hr. and for the pressures and temperatures required by the most up-to-date and efficient prime movers. It is designed to burn pulverized solid fuels, oil, or gas, singly or in combination, thus utilizing at high combustion efficiency the least expensive fuel obtainable in any locality.

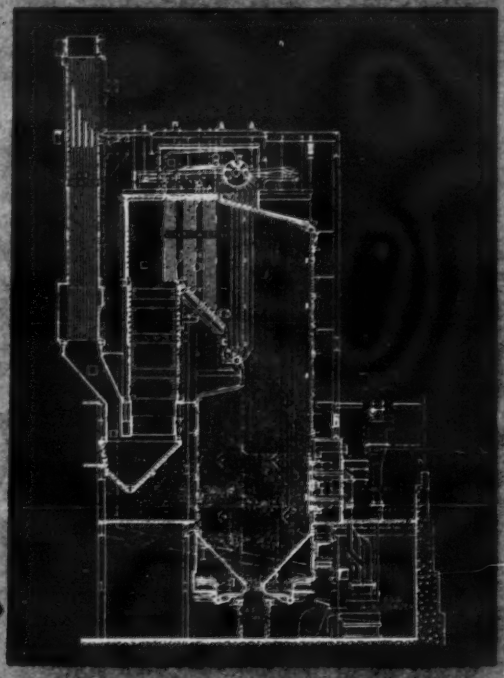


B&W CROSS-DRUM BOILER

This straight-tube sectional-header boiler is noted for its dependability, long life, and ability to deliver dry steam at high ratings. Can be readily inspected and cleaned.

CENTRAL-STATION BOILERS

High-duty boilers for central-station service are available in several basic designs to meet the requirements of individual stations. The Radiant boiler unit illustrated is typical of some of the units now operating at high rates in utility plants.



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A NEW BOOKLET JUST PUBLISHED

FOR ELECTRICAL

A SAMPLE PAGE

C-D Electrical Insulating Materials

V. Arc Resistance Tests

By E. O. HAUSMANN

The A.S.T.M. calls it D-495: A flat portion of the sample is placed beneath the points of two tungsten-tipped electrodes, which have been adjusted to a gap of 0.320 inches, and a high-voltage, low-current AC arc is increased at one-minute intervals until the material fails by becoming conducting. The frequency is 60 cycles per second, the open-circuit voltage is 12 to 15 kilovolts, and the sequence of current steps is as follows:

Sequence of Current Steps

Current, Milliamperes	Time Cycle	Approximate Rate of Heat Generation, Watts	Total Time, Seconds
10	¼ sec. on, 1¾ sec. off	3	60
10	¼ sec. on, ¾ sec. off	6	120
10	¾ sec. on, ¼ sec. off	12	180
10	continuous	24	240
20	continuous	24	300
30	continuous	45	360
40	continuous	56	420

This progressive increase is carried either to failure of the material or until the current has reached 100 milliamperes, but is not continued beyond this latter point for fear of burning the electrodes. However, practically all materials will have failed before this.

The first three steps in the above table makes use of an interrupted current cycle since a less severe condition than a continuous 10 milliampere arc is desired but a lower current arc would neither be steady nor impeccably continuous. Hence the interrupted arc. The surface of the sample should be clean and dry, for the presence of dirt, grease, moisture, or dust can seriously alter the results. Also, the Electrodes must be kept clean or wide variations in results will be attained. Even so, there will be a certain amount of variation, depending upon the by no means constant length or course of the track which appears in the test piece. This track is equivalent to a burnt pathway, for the sample is carbonized by the passage of the arc. Considerable heat is generated as can be seen in the table, and this is a contributing factor in the breakdown; in fact, most organic materials will emit acrid smoke from the test area just before the actual tracking takes place.

Material	Arc Resistance (seconds)
Diamond Vulcanized Fibre	140
Vulcoid	120
Diamond Dilecto (laminated fibre)	100
Dilectene	10
Dilecto, Grades X, XP, XXHV, XXARC	10
Dilecto, Grade XX, XXP, XXX XXXP, A, AA, C, CE, L, LE	4
Celoron	4

In most insulating problems, the information obtained by this test is of no use whatsoever. But in the case of such equipment as circuit breakers, or switches, or similar applications where there exists the possibility of arcing over the material, then it becomes of vital importance. The arc should certainly not be formed through the material as readily as through air, and the material should be of such a nature that arcs may, if necessary (or if accidental) flash across its surface without setting up a permanent track, which would allow conduction along this carbonized path and eliminate the usefulness of the dielectric. This latter possibility could be definitely dangerous in a piece of improperly-designed equipment. It should also be remembered that a high energy arc may of course cause tracking to take place much more readily than a low energy arc; this statement may seem obvious, but it not only stresses the fact that the insulation should be designed to match the equipment and the circuits but also covers the case where a low energy arc is coupled with surrounding requirements that may make it advisable to use a material whose arc resistance *per se* seems dangerously low.

When interpreting either test results or average values given for an insulating material, it is best to proceed with care for the truth of the matter is that this test has been designed more particularly to classify materials into types than into grades. Unless the differences in values are on the order of 2 to 1, these differences are practically meaningless. With sufficient experience and particularly if the actual testing itself can be observed, it is possible to draw finer distinctions, but in general any tendency to consider as significant results varying, for example, from a value of 10 to one of 14 seconds would be patently absurd except in the case of an arc of very low energy. This does not necessarily mean that test results cannot be listed as definite values, but rather that interpretation of such data should always be on the cautious side.

As might be expected from the considerable difference in the types of material, the products of Continental-Diamond show a wide range of arc resistance values, with Diamond Vulcanized Fibre heading the list and Dilecto and Celoron well down at the bottom.

With the help of special finishing varnishes it is of course possible to raise the arc resistance of Dilecto to values as high as 100 seconds. Whether or not this step is taken will depend upon the surrounding conditions of the application.

ENGINEERS CONCERNED WITH . . .

Electrical Insulating Materials

Here is a new, practical Booklet, prepared to answer the questions and meet the needs of engineers who are contemplating the use of laminated plastics, vulcanized fibre, or other insulating materials in their postwar products. It contains highly useful data on 9 different tests, and much information on insulating materials. Data includes properties — forms — graphs — fabrication — design — uses. It will pay you to write immediately for a complimentary copy.

30 PAGES OF CONTENTS INCLUDING—

- ☆ *DIELECTRIC CONSTANT AND LOSS FACTOR TESTS*
- ★ *DIELECTRIC STRENGTH TESTS*
- ★ *ARC RESISTANCE TESTS*
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- ★ *TESTS ON THE INFLUENCE OF FREQUENCY*

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ILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.

HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE

VULCOID—Resin Impregnated Vulcanized Fibre.

MICABOND—Built-Up Mica Electrical Insulation.

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Yes, worldwide war has subjected Laytex to many new conditions — not only freezing cold, but tropic heat, moisture, and shattering shock — greater strain and wear than any single wire was ever meant to withstand . . . to a degree far beyond what was expected.

Right now, the entire output of Laytex Wires and Cables is required for military needs. One day, Laytex will be once more available for Residential and Commercial Buildings, Police and Fire Alarm Systems, Communications, Signalling, Power, Control, and other exacting services.

Listen to "Science Looks Forward"—new series of talks by the great scientists of America—on the Philharmonic-Symphony Program, CBS network, Sunday afternoon, 3:00 to 4:30 E.W.T.

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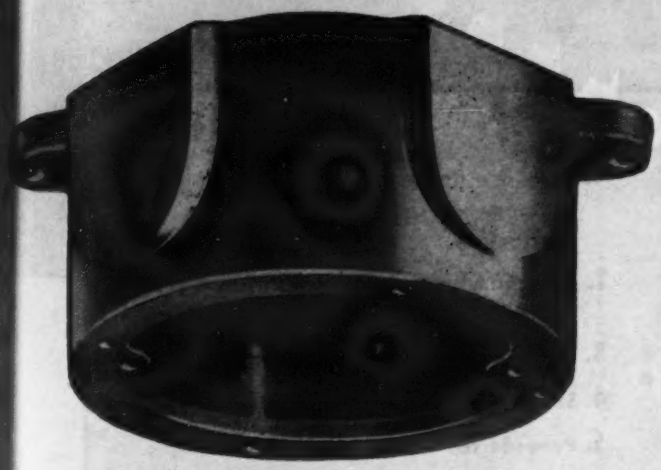
Type GRF—the adaptable CONDULET

(CONDULETS are made only by CROUSE-HINDS)



Type GRF Condulet for Surface Mounting. With Mounting Feet.

Type GRF Condulet for Flush Mounting. With Slotted Holes for Nailing to Concrete Forms.

Adaptable—many uses. Takes blank or hub covers; terminal blocks; many Condulet accessories; standard 4" outlet box covers and wiring devices. Can be used as a

- Junction Condulet
- Plug receptacle Condulet
- Lighting fixture Condulet
- Fixture hanger Condulet

Convertible. At any time after installation Type GRF Condulets can be quickly converted to other uses, as all attachments are interchangeable.

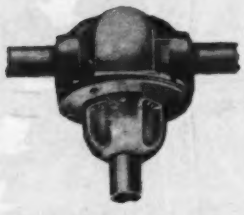
Cast Feraloy Strong and durable. Wide gasket surface for tight and weatherproof assemblies.

Bosses for drilling and tapping on sides and back. Will be furnished blank or factory tapped with tapered threads in any arrangement for ½, ¾, or 1-inch conduit.

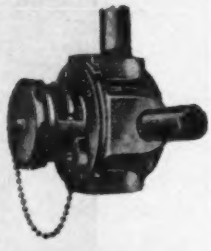
2 Styles. For flush or surface mounting.

3 Depths. 1½, 2¼, or 3 inches inside.

Listed in Condulet Catalog No. 2500, Section 15, Page 31.

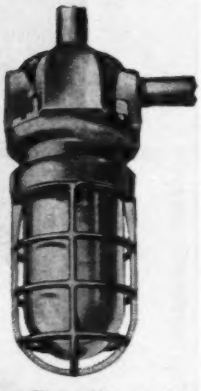


Flexible Cushion Fixture Hanger



Plug Receptacle

A Nationwide Distribution Through Electrical Wholesalers



Ceiling Type Vaportight Lighting Fixture

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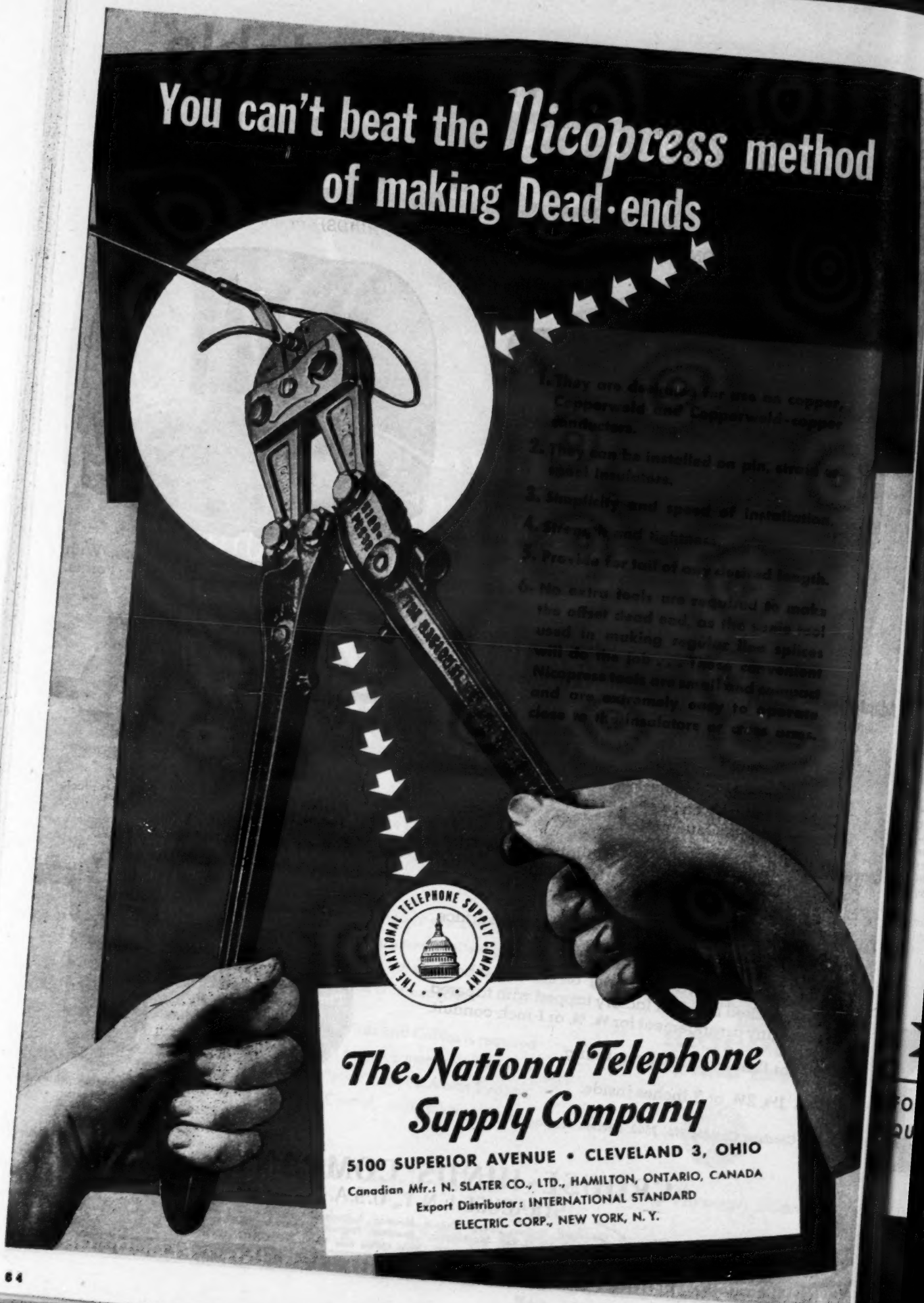

THE NATIONAL TELEPHONE SUPPLY COMPANY

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

ARE YOU INTERESTED IN SAVING TRANSFORMER CAPACITY?

ELPECO'S
NEW LOAD INDICATOR FOR YOUR TRANSFORMER IS A PERMANENT INSTALLATION!

- **Do you know whether your transformers are *under*loaded?**
- **Do you know whether your transformers are *over*loaded?**

Elpeco's New Load Indicator gives you year-round readings, records every load on your system, and enables you to save by using smaller transformers or larger transformers where there are underloads or overloads!

In no sense is Elpeco's Load Indicator a mere meter. It is a *permanent* installation on your transformer to record the load day in and day out. The time-lag feature of this device prevents swing loads indicating. It is long-lived, durable, and free of upkeep cost!

With Elpeco's Load Indicator you get a true knowledge of your transformer loads at minimum cost . . . a cost that is really nothing compared to the transformer savings it offers. The moderate price of Elpeco's Load Indicator permits permanent installation. A new informative bulletin has been prepared on these Indicators, and is offered you free to further acquaint you with this worthwhile device. Scores of requests have been received for this Bulletin within the past two months, and we invite you to write for your free copy today.

WRITE FOR FREE BULLETIN

ELECTRIC POWER EQUIPMENT CORPORATION,
412 North Eighteenth Street, Philadelphia 30, Pa
Send me FREE your Bulletin #4600 describing Elpeco Load Indicators.

Name.....

Address.....

City.....State.....

Company.....Position.....

FOR 29 YEARS MANUFACTURERS OF QUALITY SWITCHGEAR AND DEVICES

ELECTRIC POWER EQUIPMENT CORPORATION
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ELECTRIC POWER EQUIPMENT CORPORATION
412 NORTH 18TH STREET, PHILADELPHIA 30, PA.

GOULD PLANTÉ

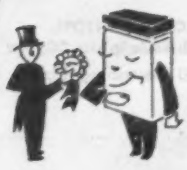
FOR LONG LIFE AND DEPENDABILITY

1916—A midwest telephone exchange installed a Gould Plante battery in 1916. After 20 years continuous service only a few parts needed replacing to restore its efficiency.

1912—A 64 cell Gould Plante battery was installed in the electric laboratory of the University of Nebraska. It is still in use after 33 years of continuous service.

1910—This battery actually powers the motors of a large swing bridge. After 26 years of steady cycle operation there was no noticeable depreciation.

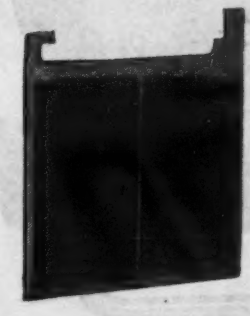
1907—Another veteran bridge worker, this Plante battery ran steadily from 1907 to 1933. Then a location change made certain new parts necessary and the battery continued in use.



1904—A "Gold Medal" winner at the Louisiana Purchase Exposition in 1904, this Plante battery still supplies direct current needs at the University of Illinois.

1902—Installed in the U. S. Bureau of Standards this Plante battery was still in excellent operating condition when retired in 1933 because of equipment changes.

Plante one-piece, pure lead positives have ribbed surfaces that are electro-chemically treated to coat them with a dense film of positive active material. This film minimizes further peroxidization of the base lead structure and is one of the reasons for Plante's exceptional service life.



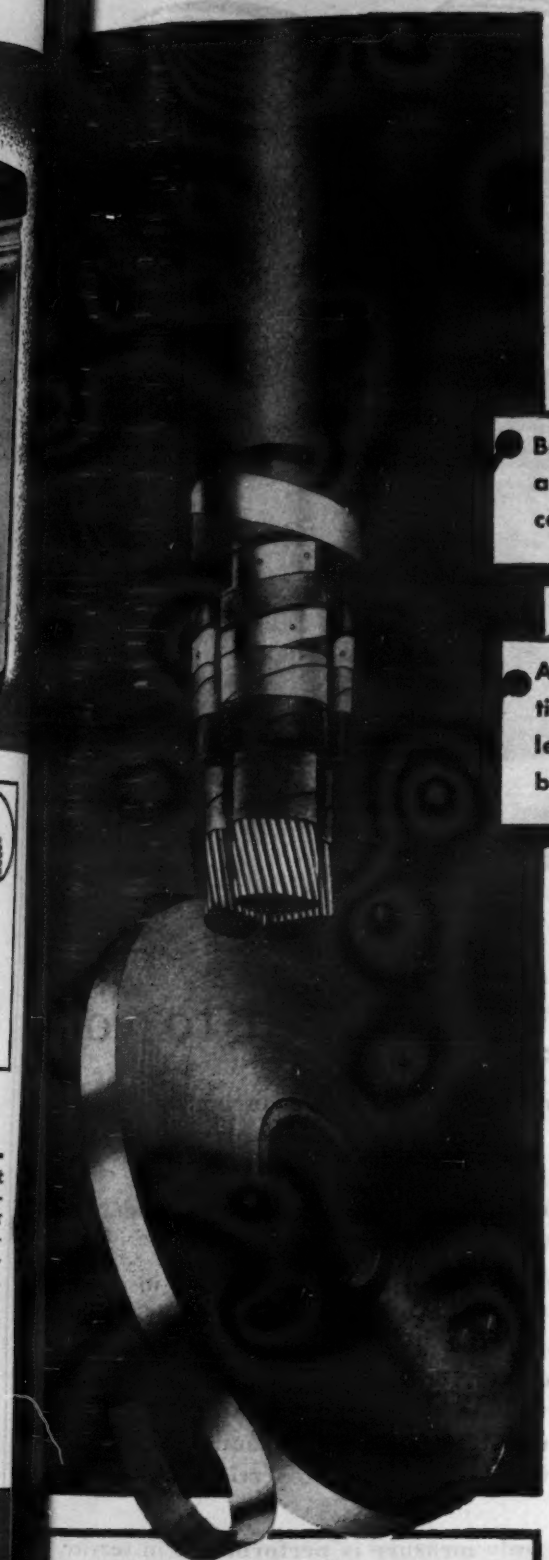
Plante Dual Suspension and element support transmits element weight to the jar walls. This prevents premature failure due to distortion, cover breakage, or short circuits.

Write Dept. 12S for Catalog 1000 on Gould Sealed-in-Glass Batteries for Stationary Applications.

GOULD

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT.

GOULD STORAGE BATTERY CORPORATION, Depew, New York



SEALED IN:

Maximum Power
Minimum Deterioration

Between insulation and outer sheath, K-D Metallized Paper Tape acts as an electrostatic shield . . . eliminates power leaks due to corona . . . reduces excessive ionization.

As a barrier between conductor and oil-impregnated paper insulation, K-D Metallized Paper Tape prevents chemical reactions that lead to cable deterioration...provides uniformity of electrical stress by giving a smooth base for winding insulating tape.

PAPER-INSULATED POWER CABLES wrapped in Keller-Dorian Metallized Paper Tape deliver more power at the meter...longer, more efficient cable service. That's because use of the tape results in higher dielectric strength...greater breakdown values...higher safety factor...slower thermal aging of impregnated paper ...improved power factor

You can get these advantages by specifying Keller-Dorian Metallized Paper Tape protection in ordering electrical wires and cables. Keller-Dorian Corporation, Empire State Building, New York 1, N.Y.

You'll find K-D Metallized Paper Tape, in many standard types or to your specifications, in wires and cables made by these leading manufacturers:

General Cable Corporation
General Electric Company
Okonite-Callender Cable Co.
Simplex Wire & Cable Co.
U. S. Rubber Co.

KELLER-DORIAN
CORPORATION

Empire State Building, New York 1, N. Y.

METALLIZED PAPER TAPES
FOR ELECTRICAL WIRES AND CABLES

This insulator . . .

must pass 65

checks, inspections and tests . . .

before it is shipped to you.

The original Cap and Pin Type Suspension Insulator, designed and manufactured by Locke in 1903.

The engineer turns his design over to the Manufacturing Department for a trial run. The boys in the laboratory grab the results and give 'em the works.

Their report is studied and on the basis of the procedure established by the trial run, the unit goes into production.

We could leave it there and the majority of the production insulators would undoubtedly come up to specifications. But that's not enough. The longer life, higher strength and greater uniformity and stability designed into the insulator to save you time and money must extend to every last insulator built. That's why all along the line from the receipt of the raw materials until the final nail is hammered into the last crate, a constant, continuous control is exercised over every ingredient, part and process.

This is Locke quality and its only measure is performance in service.

And service records on millions of Locke insulators operating in all parts of the world fully testify to the very real benefits you derive from the extraordinary attention we pay to even the smallest detail.

LOCKE Insulator Corporation

BALTIMORE • • MARYLAND

MITCHELL-RAND

THE ELECTRICAL INSULATION HEADQUARTERS for 56 YEARS

FREE FOR THE ASKING!

Write today for your Free Varnished Tubing samples ranging from size 0 to 20 to fit wires from .032 to .325 inches . . . other valuable aids, are the M-R Guide Book of Electrical Insulation . . . the Wall Chart with reference tables, electrical symbols, allowable capacities of conductors, dielectric averages, thicknesses of insulation and tap drill sizes . . . and the M-R Wax and Compound Guide Book . . . they are full of valuable information . . . write for them on your letterhead.

MITCHELL-RAND INSULATION COMPANY, INC.

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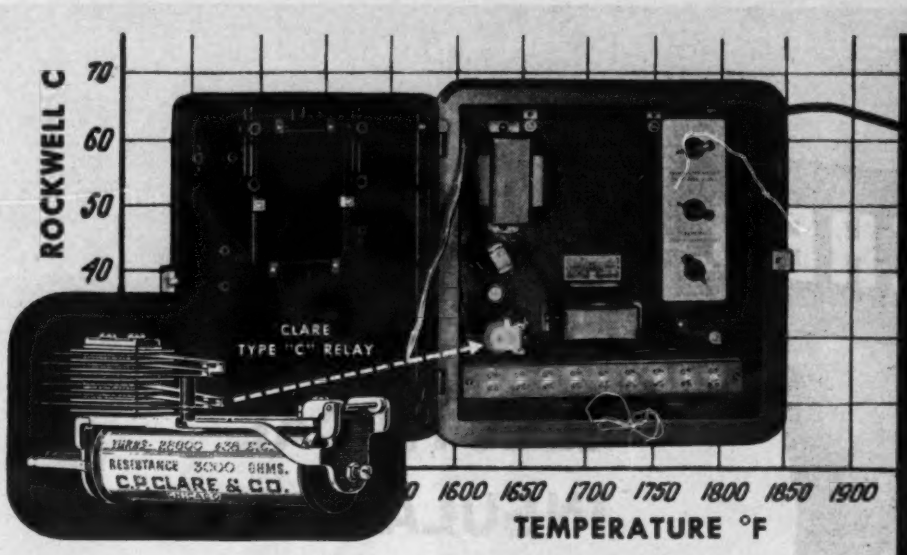
EST. 1889

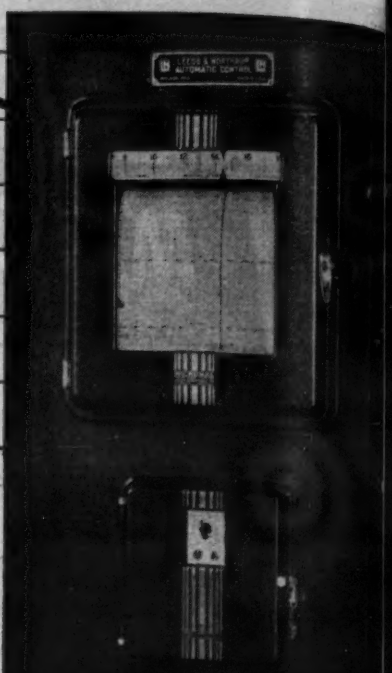
A PARTIAL LIST OF M-R PRODUCTS

Transformer Compounds
Friction Tape and Splice
Cable Filling and Fothead Compounds
Fiberglas Varnished Tape and Cloth
Insulating Papers and Twines

Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing

Fiberglas Braided Sleeving
Cotton Tapes, Webbings and Sleevings
Impregnated Varnish Tubing
Insulating Varnishes of all types
Extruded Plastic Tubing





CLARE *"Custom-Built"* RELAYS

Help Micromax Electric Controls Maintain Precise Furnace Temperatures

Clare Type "C" Relay is used to regulate the flow of electric energy in the Micromax Electric Control. This product of Leeds & Northrup Company of Philadelphia, Pa., proportions the duration of "on-heat" to "off-heat" which provides the precise, even heat control demanded in the operation of electric furnaces, ovens and baths.

To maintain precise temperature the Micromax Electric Control employs two electrical balances: one to measure temperature; the other to carry out control action. A knob on the control instrument is set to prevent temperature from overshooting the control point . . . especially important when a furnace is being brought to temperature under a full heat-head.

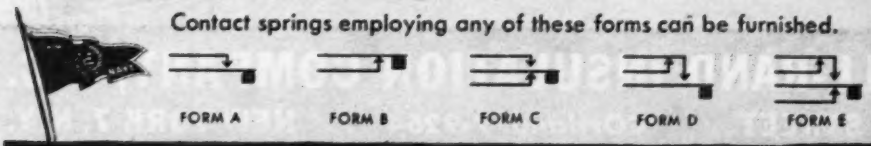
Whenever the temperature leaves the control point, a Clare Relay modifies the on-off action of the contactor to readjust heat-input and restores balance in the control circuit.

Leeds & Northrup engineers chose a Clare Relay for this important part of their control unit because the flexibility of Clare "custom-building" gave them the sensitive, positive action, the absolute dependability, and the accuracy to meet most exactly their requirements.

This use of Clare "Custom-Built" Relays to operate delicate controls is typical of the way in which engineers and designers everywhere are finding Clare the exact relay for the unusual application. The Type "C" Relay offers you a design that permits a wide range of contact ratings, the choice of five different contact forms or any combination of them, either flat or hemispherical contacts of rare metals or special alloys, coil windings to match the circuit and application.

What is your problem? Let Clare "custom-build" a relay to your specifications. Investigate the possibilities for higher efficiency and reduced relay costs. Send for the Clare catalog and data book. Address C. P. Clare & Co., 4719 Sunnyside Avenue, Chicago 30, Illinois. Sales engineers in all principal cities. Cable address: CLARELAY.

Contact springs employing any of these forms can be furnished.



High voltage pile-up insulation withstands heavy break-down tests.

Contacts of rare metals and special alloys, welded to nickel silver springs

Spring bushing insulators made by a patented process from Bakelite rod

Double arm armature, stainless steel shaft in brass yoke can be furnished

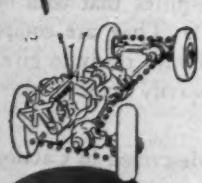
CLARE RELAYS

FWDs ARE RUGGED *Dependable* PRIME MOVERS

In everyday duty for utilities, FWDs regularly do 61 jobs. Including special jobs, there are more . . . write for list. For all year 'round utility truck work, you can always depend on FWDs.

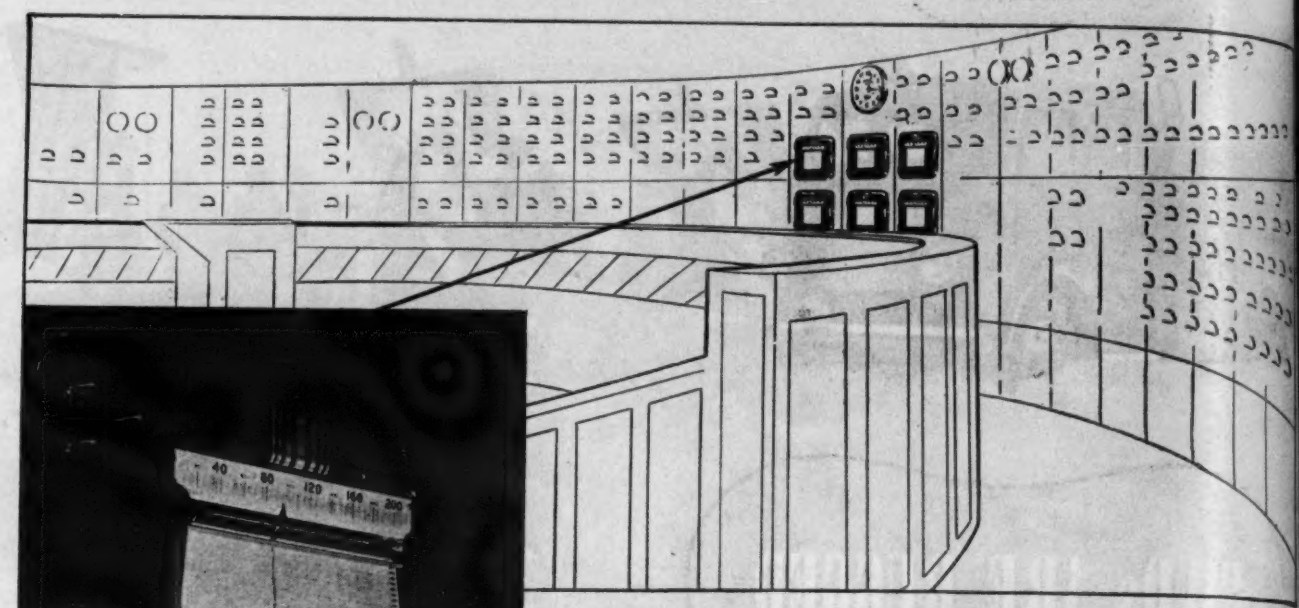
FWD trucks . . . rugged, reliable, modern . . . embody the highest development of the original four-wheel-drive principle, pioneered and advanced by FWD since 1910. The true FWD principle with center differential and properly balanced power on all wheels, gives these trucks outstanding mechanical advantages and performance leadership . . . the FWD principle that provides the power and stamina to get through . . . regardless of weather, road conditions or lack of roads . . . with greater assurance and safety. Balanced weight distribution on all four wheels conserves precious tires, replacements, oil and gas. As leaders in performance, economy and style, FWDs are a great "buy" for utilities. Their value is so widely recognized that they are used by over 200 utilities, many of which operate large FWD fleets.

THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wisconsin
Canadian Factory: Kitchener, Ontario



FWD
TRUCKS
THE ORIGINAL EXCLUSIVE BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS

More than $75,000,000 in purchases of FWD Model SU alone in the comparatively short span of forty-eight months, emphasizes FWD leadership in this field!



The Record of a Micromax Helps With Overloads

When war work causes big generators to approach an overload condition (as many now do) the operating engineers are finding a new use for the Micromax Recorders of stator and rotor temperatures. They are watching temperature as never before, because it is temperature which eventually limits the load piled on a machine. When a change in power factor or ambient temperature permits a load increase, the stator and rotor temperatures are watched to say . . . how much!

Because a generator's field may change in temperature more rapidly than does the stator, the Micromax Field Temperature Recorder is sometimes a more sensitive guide than the Stator Recorder, especially under conditions of poor power factor. When a difference exists, it is accentuated by the fact that the Field Recorder is a single-point instrument, giving a continuous record of the temperature of the entire rotating mass of copper, whereas the Stator Recorder measures 8 points, so that none is continuous. For this reason, the Field Recorder may be more frequently consulted in routine operation.

The fact that the stator temperature does move more deliberately, however, makes many engineers prefer it as an operating guide, and complete protection against overheating requires that both field and stator recorders be the "insurance policy". They are equipped for signal lights and horn or bell, and stand always ready to give overall protection to generators, whether they be heavily loaded or overheated by accident.

Both of these Micromax Recorders are described in Catalog N-33-161, "Micromax Temperature Instruments for Electric Power Equipment", which is sent on request.

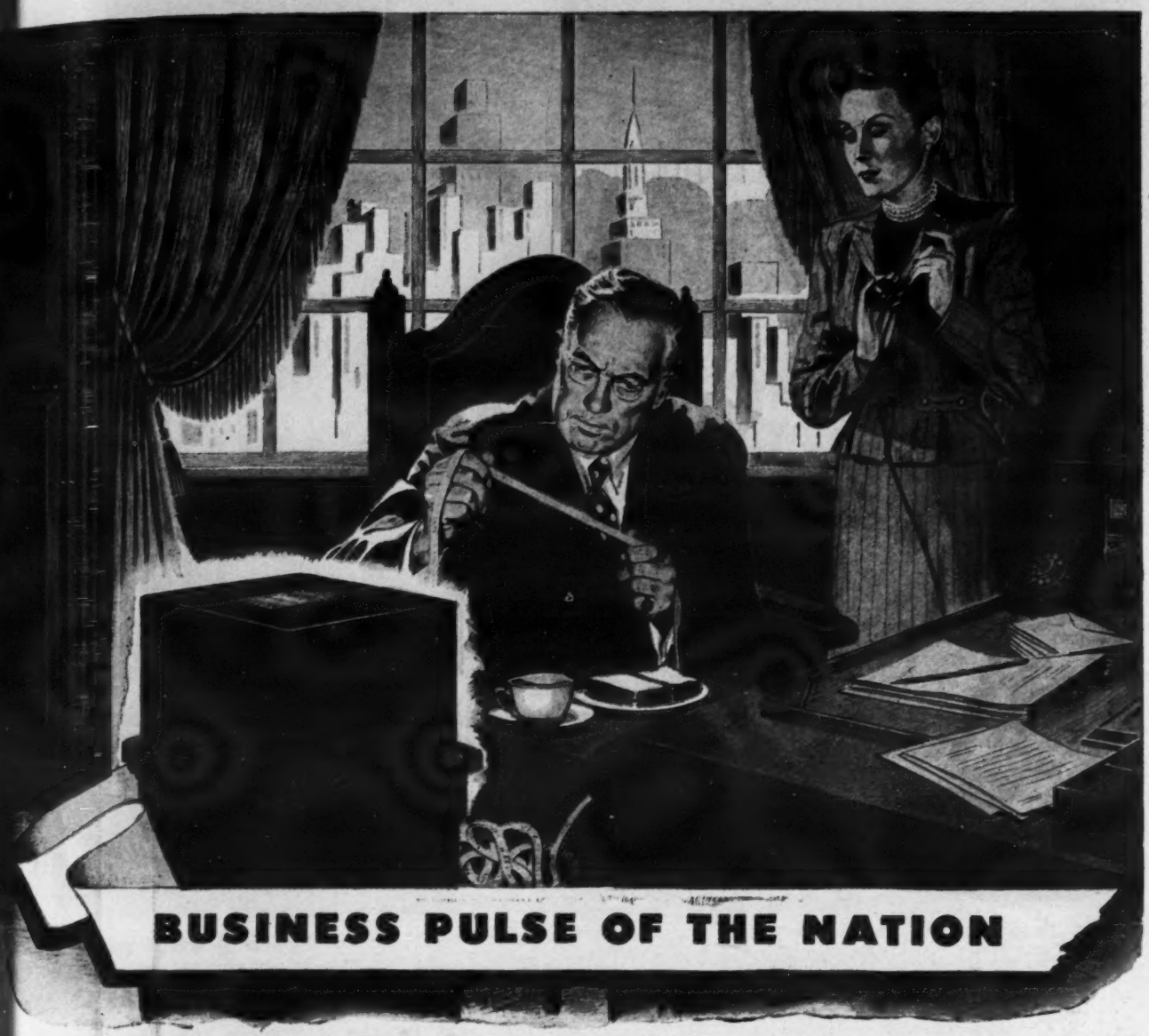
LEEDS & NORTHRUP COMPANY, 4958 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

Jrl Ad N-33-161(6)

V depends on me!
A Slogan For Every American



stantly and simultaneously, stock otation tickers flash minute-by-inute market reports from coast coast. These business pulses of e nation must be accurate and re-able, and to help assure uninter-pted service, Western Union em-oys cables protected by VINYLITE stic insulation!

In this application—as in others, doors and out—Western Union nds that VINYLITE plastic insula-on brings valuable advantages er older types. Its dielectric strength permits thin-wall, small-diameter construction. It is highly resistant to aging, flame, moisture, abrasion, and most acids, alkalies, alcohols, and solvents. It remains flexible even at low temperatures. And VINYLITE plastic insulation can be made in a wide range of colors for easy identification — opaque, transparent, and crystal clear.

On instrument wire, you will probably find, like Western Union, that VINYLITE plastic insulation has better heat resistance than insulation formerly used. You will find, too, that it brings new standards of outdoor performance where wide temperature variations and heavy external loadings on the conductors are encountered. Write Department 28-VR for the booklet "VINYLITE Plastics for Wire and Cable Insulation."

BAKELITE CORPORATION
Unit of
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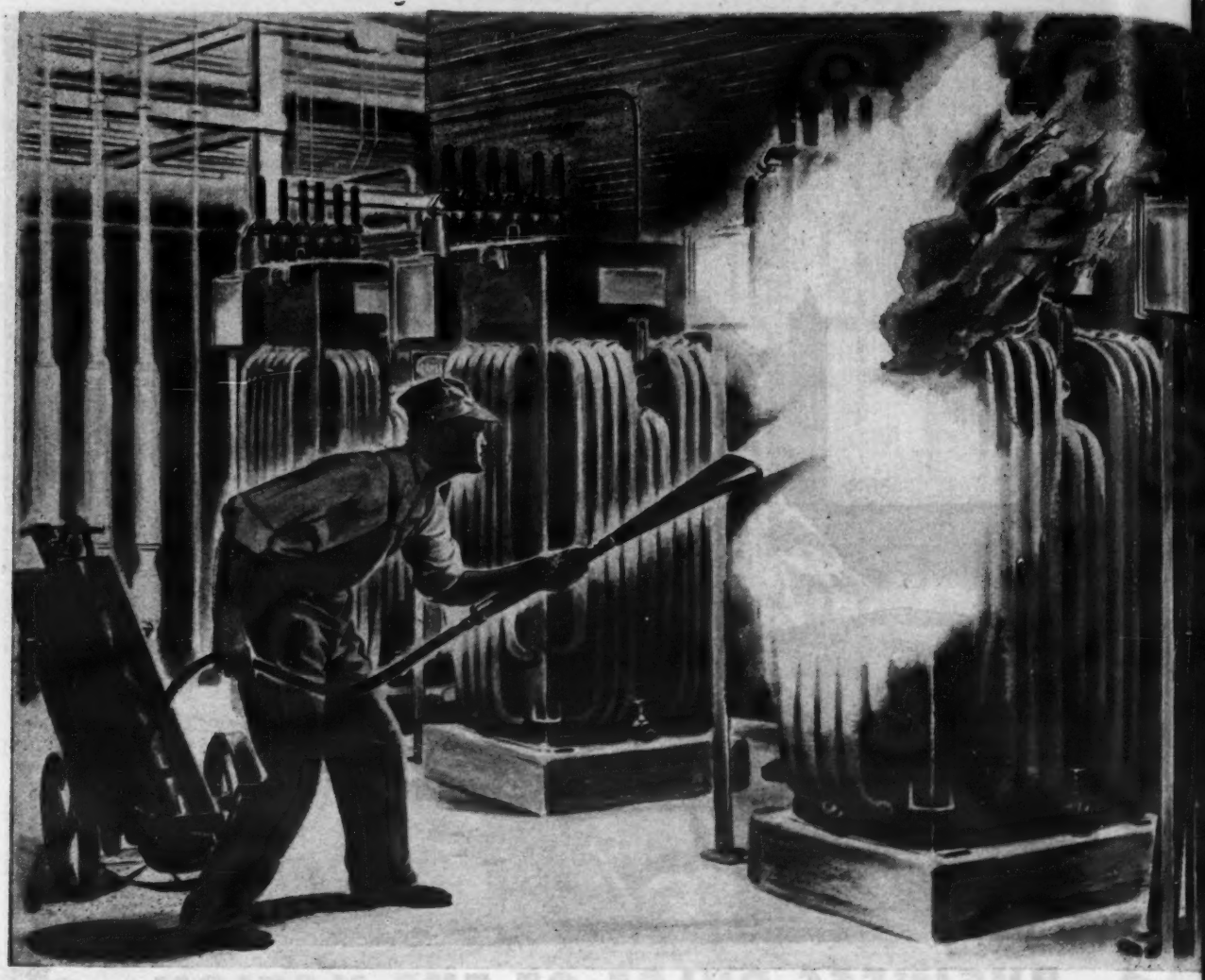
UCC
30 EAST 42ND ST., NEW YORK 17, N.Y.

Vinylite Plastics

TRADE-MARK



Clamp a Quick Strangle-hold on Fire

Kidde Kills Tough Fires

- GENERATORS
- MOTORS
- CONDENSERS
- CONVERTERS
- TRANSFORMERS
- SWITCHGEAR
- LIGHTNING ARRESTERS
- RECTIFIERS
- REGULATORS
- FLAMMABLE LIQUID STORAGE
- FILTER RECIRCULATION

• Choking fires in electrical equipment in their incipient stages is a simple job—for the Kidde Wheeled Extinguisher. Ordinary water-type extinguishers can't do this job...but the Kidde model 50 wheeled unit, with its specially designed horn and nozzle, kills these tough blazes *fast* by smothering them under a thick blanket of carbon dioxide gas.

This dry, inert, non-conducting gas quickly penetrates through openings in housings, or mazes of wiring, to blast out all flame it meets. There's no danger of shock to the operator ...no rotting of insulation or water-soaking of apparatus...no after-fire mess to be cleaned up.

When fires break out in flammable liquids, Kidde equipment is equally fast, equally safe . . . extinguishing the flames without contaminating or diluting the liquids.

Look over the accompanying list of typical fire hazard areas. If any of them need protection, call in a Kidde representative — you'll find him wise in the ways of fire protection. Drop us a line.

K Kidde

ARMY E NAVY

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

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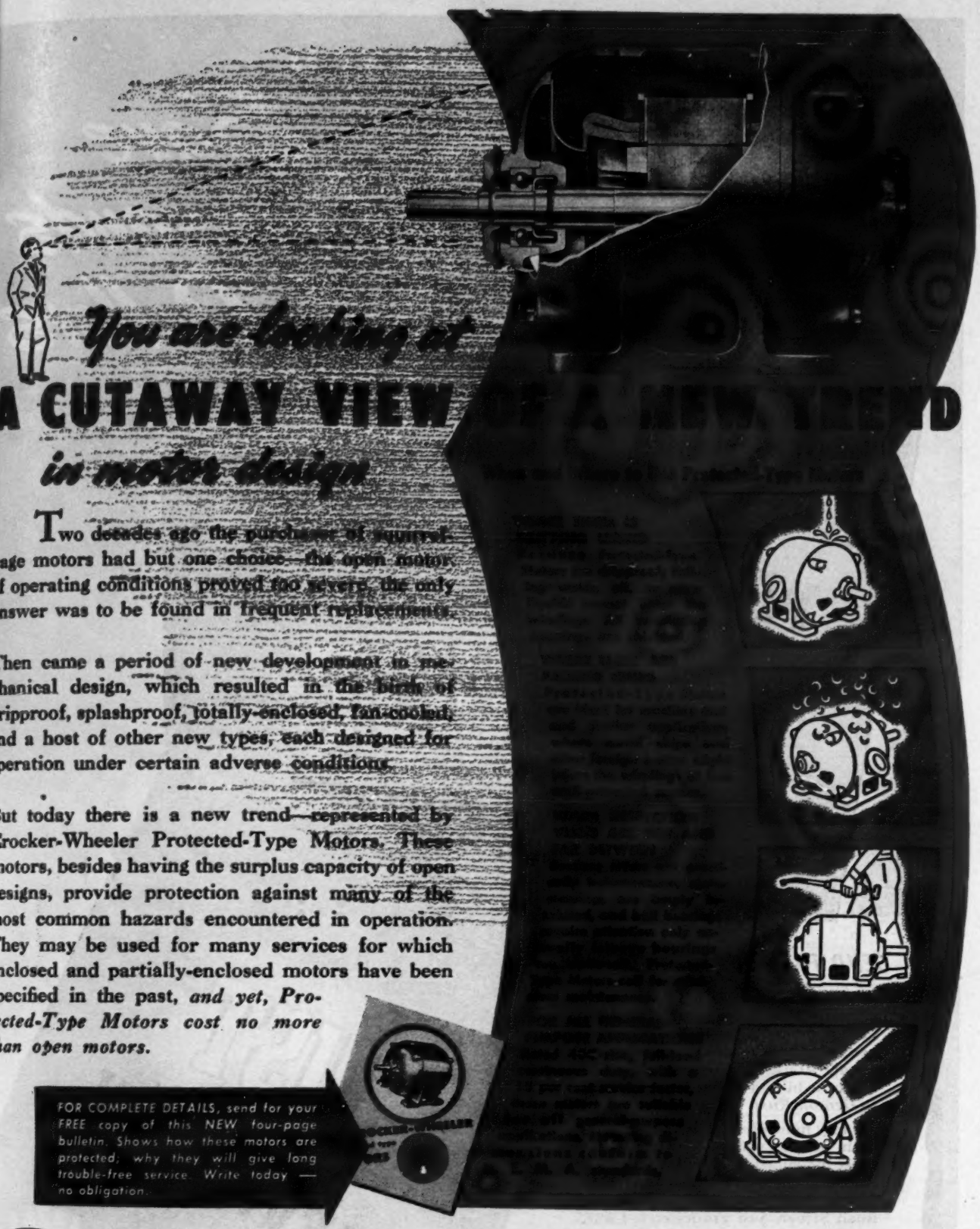


You are looking at

A CUTAWAY VIEW OF A NEW TREND

in motor design

Two decades ago the purchaser of squirrel-cage motors had but one choice—the open motor. If operating conditions proved too severe, the only answer was to be found in frequent replacements.

Then came a period of new development in mechanical design, which resulted in the birth of dripproof, splashproof, totally-enclosed, fan-cooled, and a host of other new types, each designed for operation under certain adverse conditions.

But today there is a new trend—represented by Crocker-Wheeler Protected-Type Motors. These motors, besides having the surplus capacity of open designs, provide protection against many of the most common hazards encountered in operation. They may be used for many services for which enclosed and partially-enclosed motors have been specified in the past, *and yet, Protected-Type Motors cost no more than open motors.*

FOR COMPLETE DETAILS, send for your FREE copy of this NEW four-page bulletin. Shows how these motors are protected; why they will give long trouble-free service. Write today — no obligation.

CROCKER-WHEELER

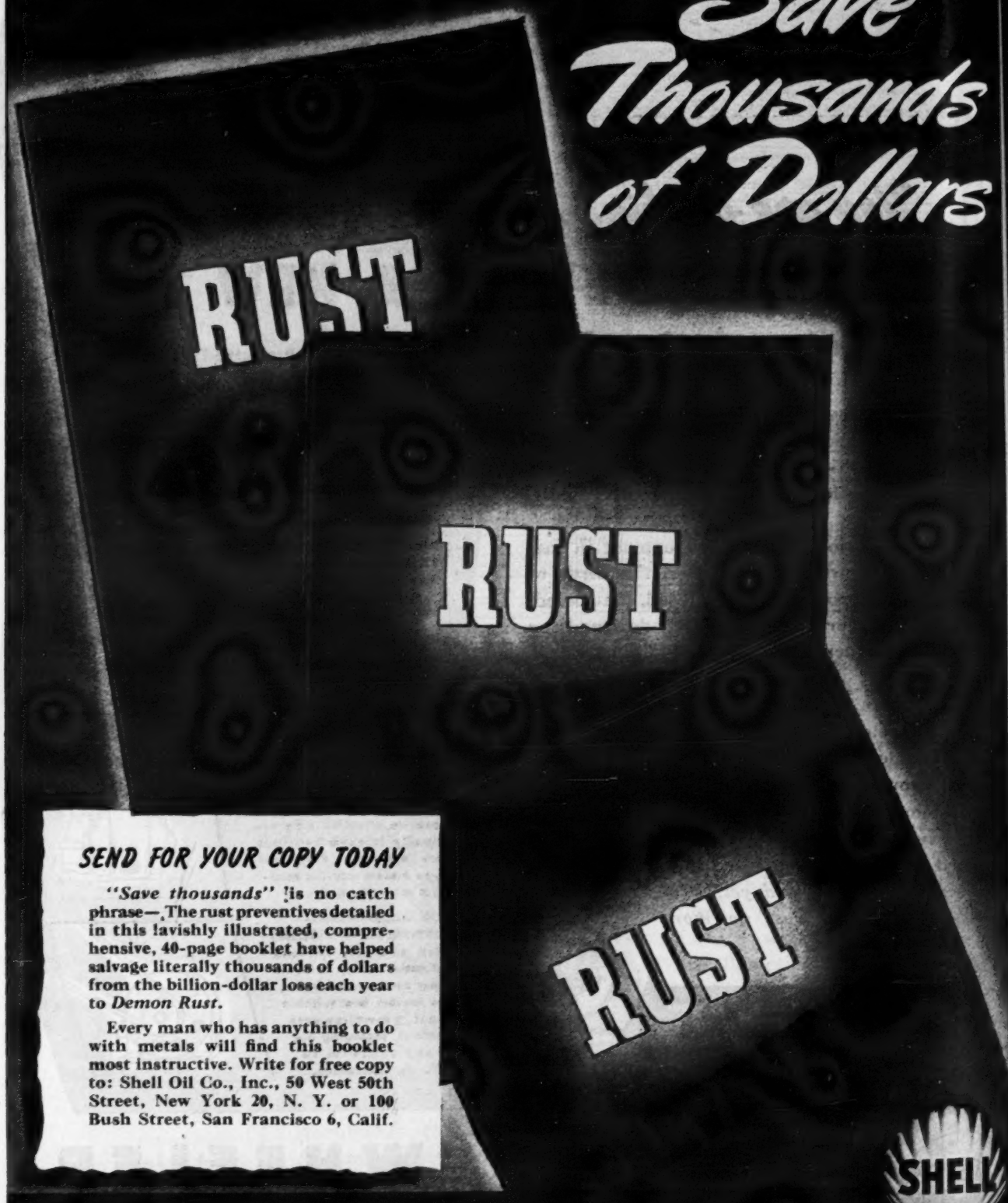
A DIVISION OF JOSHUA HENDY IRON WORKS, AMPERE, NEW JERSEY

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON

SQUIRREL CAGE MOTORS WOUND ROTOR MOTORS DIRECT CURRENT MOTORS GENERATORS FLEXIBLE COUPLINGS

THIS BOOKLET CAN HELP YOU

Save Thousands of Dollars



SEND FOR YOUR COPY TODAY

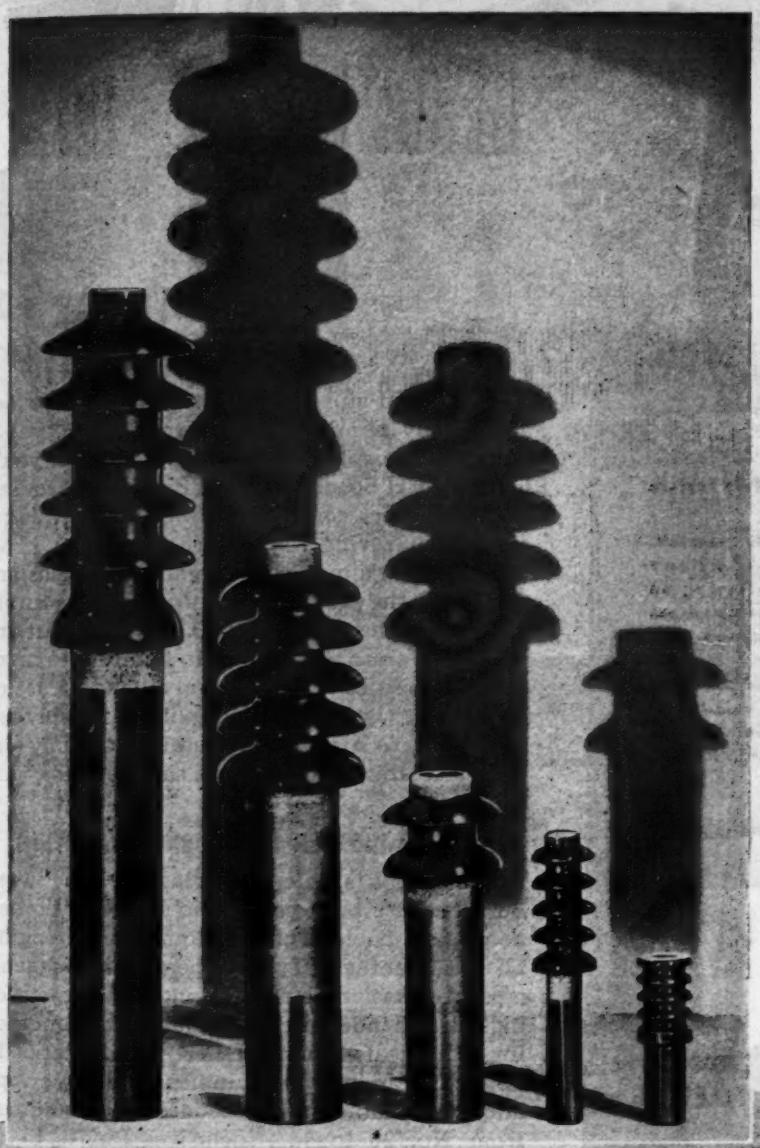
"Save thousands" is no catch phrase—The rust preventives detailed in this lavishly illustrated, comprehensive, 40-page booklet have helped salvage literally thousands of dollars from the billion-dollar loss each year to *Demon Rust*.

Every man who has anything to do with metals will find this booklet most instructive. Write for free copy to: Shell Oil Co., Inc., 50 West 50th Street, New York 20, N. Y. or 100 Bush Street, San Francisco 6, Calif.

SHELL

SHELL RUST PREVENTIVES
. . . OILS . . . FLUIDS . . . COMPOUNDS

ILLINOIS *Porcelain*
TRANSFORMER BUSHINGS
made to customer's specifications



THESE bushings are not carried as standard stock items but are made in accordance with specifications furnished by customers. Each individual need is thereby specifically provided for and can be duplicated at any time with the assurance of uniformity.

Control of production methods assures uniformity of ILLINOIS Porcelain. Internal Stress is eliminated—exact dimensions are assured—accurate kiln firing prevents strain.

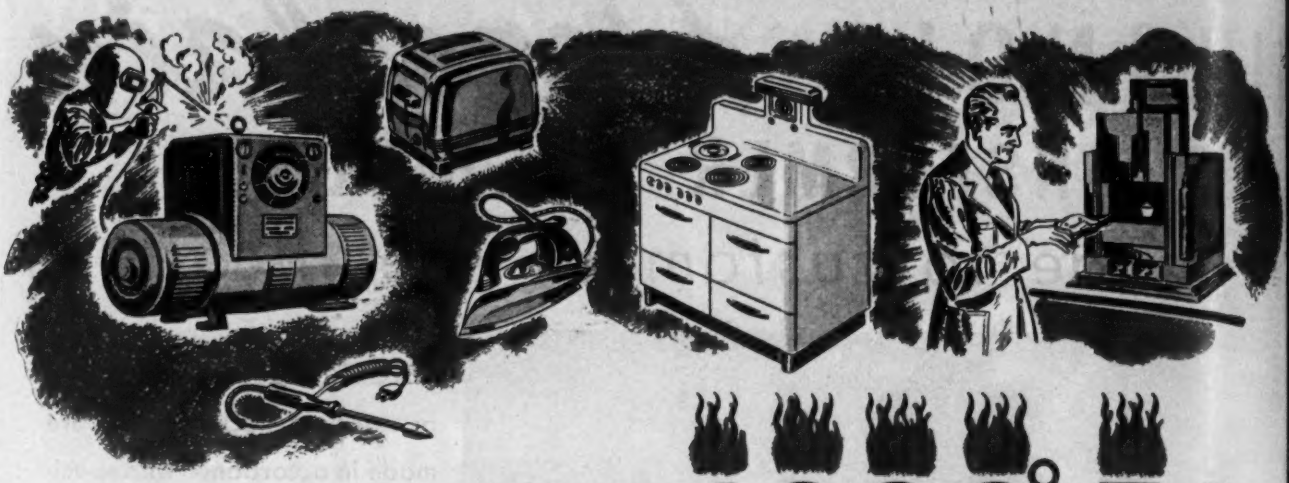
These bushings can be standard glaze or radio interference proof glaze. Dry Type Bushings are made for all voltages up to 34.5 kv. Gasket Seats are smooth and ground when required.

They accurately line up in the transformer case

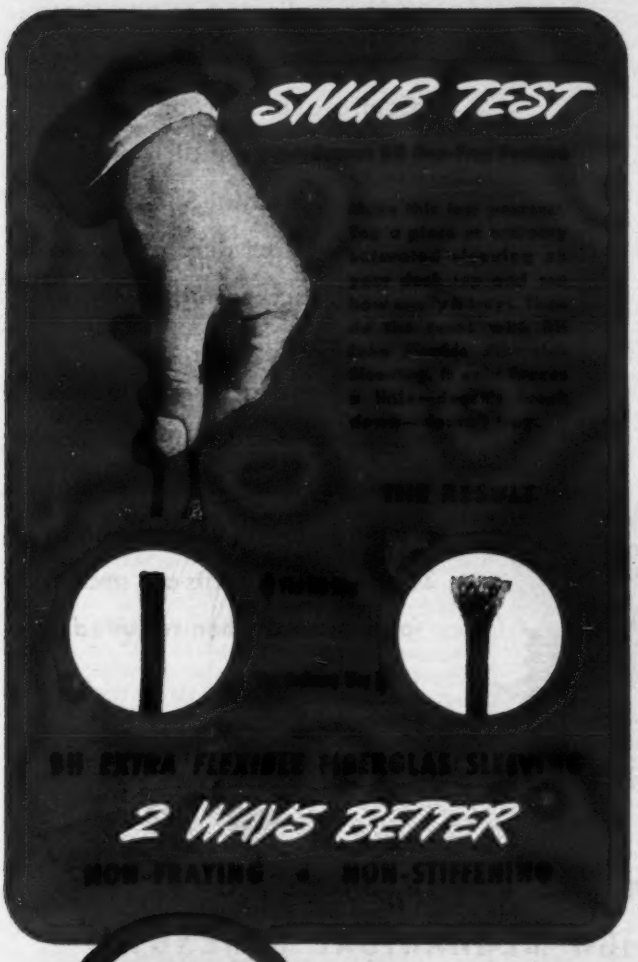
HIGH DIELECTRIC STRENGTH ·· HIGH MECHANICAL STRENGTH
EXACT DIMENSIONS AND UNIFORMITY

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

BH SPECIAL TREATED FIBERGLAS SLEEVING



HEAT RESISTANT TO 1200° F!



IF YOU NEED an electrical insulation that's not affected by temperatures up to 1200°F., yet is unusually flexible, workable and durable, you'll find it in BH Special Treated Fiberglas Sleeving. Even in direct contact with heat units this remarkable sleeving won't burn.

Reason? It's made of inorganic Fiberglas and treated by the exclusive BH process. No saturant is used, yet the sleeving won't fray when cut and it is *permanently* flexible. In addition to many other properties it is moisture, oil and grease resistant . . . works easier, simplifies assembly and lasts longer. Made in natural color only—all standard sizes. Get your free samples today and compare!

HERE'S ANOTHER NON-BURNING SLEEVING

BH *Extra Flexible* Fiberglas Sleeving won't burn because both yarns *and* impregnation are non-inflammable. This high quality sleeving has all the advantages of pure Fiberglas, is toughened against abrasion, is non-fraying and non-stiffening. It lasts indefinitely without rotting or cracking—the ideal all-purpose electrical insulation for all kinds of industrial equipment and home appliances. Available in all standard colors and sizes from No. 20 to 5/8", inclusive. Put it to the toughest tests you know and watch the results!

ALL BH PRODUCTS AVAILABLE IN STANDARD 36" LENGTHS AND 500-FT. COILS

BH PRODUCTS

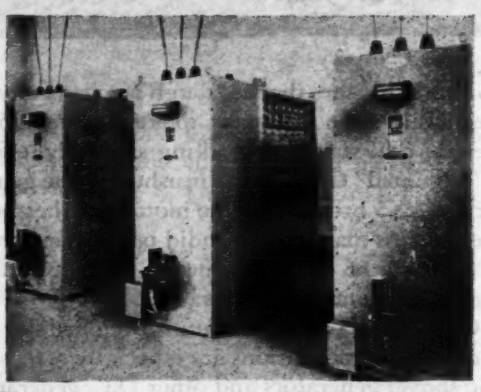
Dept. W Conshohocken, Penna.

MORE VOLTAGE *at critical load points quickly*

with Large Banks of C-D CAPACITORS

Large blocks of leading reactive current can be obtained quickly by using banks of Cornell-Dubilier Capacitors. Voltage can be increased at critical load points in this way, which will also improve system capacity. Many utilities have found the answer to this problem by using C-D's in banks of 8,000, 15,000, 20,000, 40,000 KVA, etc., to provide large concentrated loads.

C-D capacitor banks, quickly reassembled, will meet variations in corrective capacity to conform to load requirements, affording the electrical and physical flexibility not available in other types of corrective equipment. Our engineers will gladly advise on specific applications of C-D capacitor banks for your system. One of our field engineers is near you, call on him for information. Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.



C-D CAPACITORS IN SUB STATION

These 720 Kva, 4160 volt, 3-phase, 60 cycle Dykanol "A" indoor station-type capacitors are installed in the substation of a large Eastern utility. They are automatically switched by voltage control.

CORNELL-DUBILIER CAPACITORS

FOR POWER FACTOR IMPROVEMENT
CARRIER CURRENT COUPLING
SURGE PROTECTION

Heavy Loads and Violent Surges Demand SA45's and AX5's

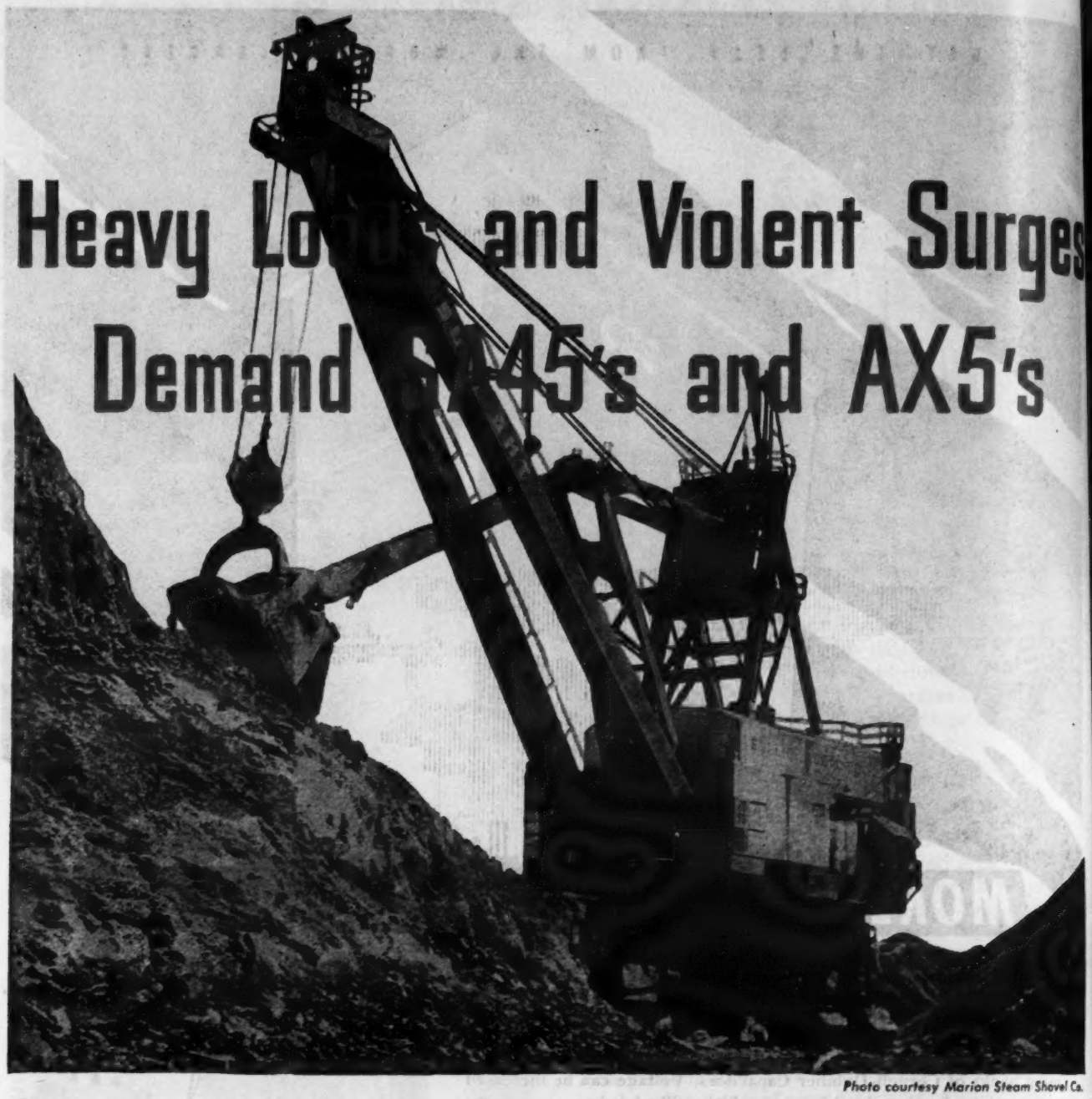


Photo courtesy Marion Steam Shovel Co.

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"National" Grade SA45 brushes for the generators and Grade AX5 brushes for the motors are helping many of these giants maintain splendid performance records even in the face of extremely heavy loads, repeated current surges and continuous operation.

Grade SA45 brushes were developed for use where commutating conditions are especially severe, as on electric shovel generators and other D.C. generators, motors and rotaries requiring high commutating ability. The heavy-duty Grade AX5's are outstanding brushes for D.C. shovel motors, as well as for all classes of traction, mine and mill motors.

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Full details on MELMAC P-3020 and other MELMAC plastic molding materials developed by Cyanamid for use in ignition systems, electric controls, and other similar applications where its excellent insulating properties are essential, will be supplied promptly.

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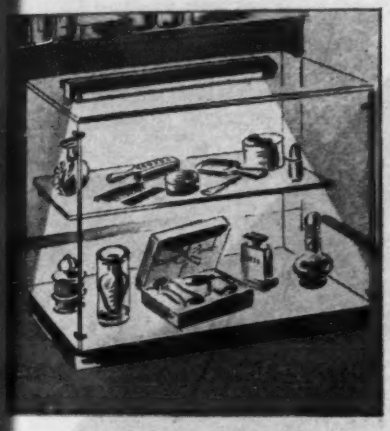
SYLVANIA NEWS
CENTRAL STATION EDITION

AY *Published by* SYLVANIA ELECTRIC PRODUCTS INC., Salem, Mass. 1945

IDER FLUORESCENT SE IN 21-INCH LAMP

ew-Size Lamp Fits to Small Spaces

blic utilities, particularly those active educating the consumer to modern hting possibilities, will be interested in e applications provided by Sylvania ectric's new 21", slim fluorescent lamp. Showcase illumination, for example, s always presented difficulties. First, latively high levels of light within the se are desirable, and the space into ich the source must fit should be kept small as possible. Then there are probms of odd case lengths where the standd T-8 lamps will not fit, leaving



nsequent gaps in the lighting. Also, fficiency demands a reflector of a size hat does not fit closely around the lamp.

Five-eighths of an inch in diameter, his latest addition to Sylvania's miniure fluorescent line should be recomended for use in window displays and howcases, where a minimum of obstruction to the line of vision is necessary. Further possibilities for using the new amp are in stair landings, doorways, icket windows and the bathrooms and itchens of homes. Although of the slim ype, the lamp uses a standard FA-3 iniature bi-pin base and an FS-4 starter.

NEW POSITION INDICATOR ANOTHER SYLVANIA FIRST

Plastic Base Fluorescents Have Added Over-the-Counter Appeal

Representing another major advance in the modern lighting field, position indicators—molded into the new plastic base of Sylvania Electric fluorescent lamps—offer an exclusive feature that will boost over-the-counter sales. When the lamp is correctly inserted in the lamp-holder, an indicator, placed on the shoulder of the cap at right angles to the pins, points down. The touch of a finger is the only check required for positioning.

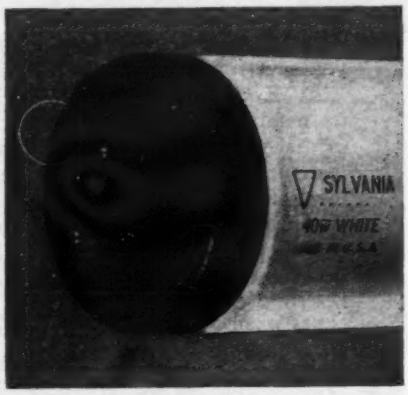
Since these new lamps can be installed more easily, replacement of dead lamps can be made more quickly—obviously helping to maintain connected load.

Besides, this sure method of checking lamp installation by position indicators will mean fewer lamps coming loose or falling from their holders. Servicing of installations will be simplified—a factor of great importance.

In addition, the new plastic base is unaffected by normal conditions of excessive moisture or acid vapor in the air. A stronger, ribbed interior construction of the cap lessens the chance of a loose base or pushed-in pins.

THE OLD WAY: *A final squint was needed to be sure lamp was correctly positioned.*

THE NEW WAY: *Position indicator instantly verifies correct mounting.*



Here is the new plastic base, moisture- and vapor-resistant, with position indicators.

SYLVANIA ELECTRIC

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TO BAR THE BLACK HAND OF CORROSION

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When You *Don't* Want to Draw Powe

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HAVING the very wide d-c voltage range of 0.05 to 3,000 volts with exceptionally high input resistance, this new d-c v-t voltmeter is very useful in radio and electronic circuit design and testing.

Small, portable, lightweight, self-contained and accurate the new Type 728-A Voltmeter is especially useful when voltage measurements have to be made without drawing power from the circuit.

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HIGH INPUT RESISTANCE — Over 5000 megohms on ranges below 100 volts; 1000 megohms above

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NEGLIGIBLE A-C EFFECT — superimposed a-c voltage up to 200 has negligible effect on meter indication

REVERSING SWITCH — switch on panel to ground either positive or negative terminal of source being measured

BATTERY OPERATED — instrument supplied complete with batteries

PORTABLE — weighs only 9¾ pounds with batteries; dimensions (length) 11 x (width) 6⅝ x (height) 5¼ inches with cover closed

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- HIGH INPUT RESISTANCE
- GOOD ACCURACY
- NO A-C EFFECT
- PORTABLE
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TYPE 728-A D-C VACUUM-TUBE VOLTMETER $1[illegible]

At present this instrument is available only for high priority war orders; reservation orders for later deliveries are being accepted.

Write for a copy of the G-R Experimenter for December 1944 for complete description of this instrument.

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FOR SECTIONALIZING 600 VOLT CABLE CIRCUITS

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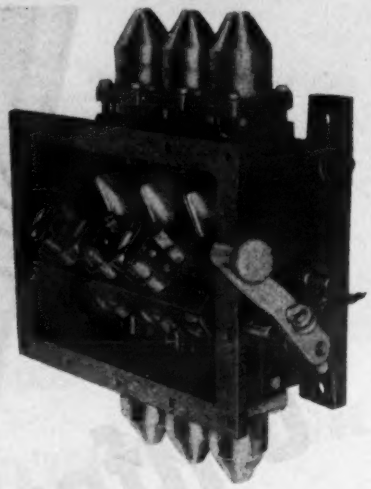

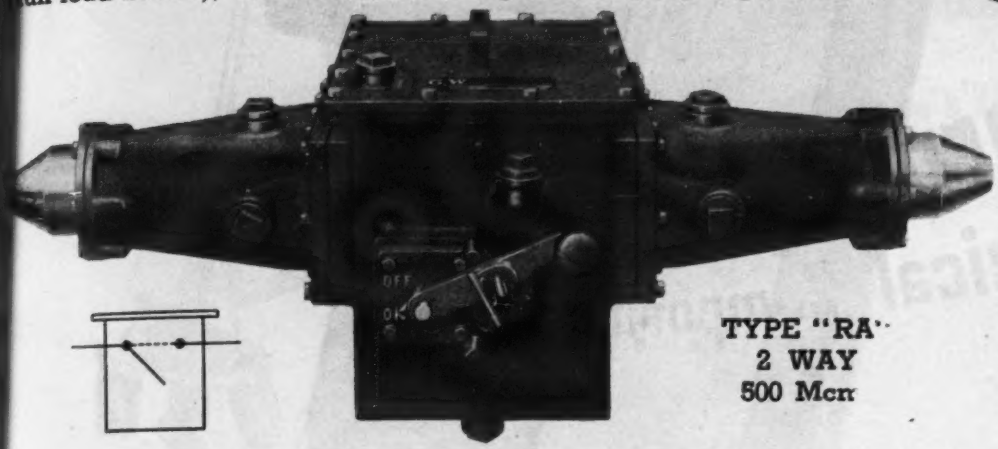

TYPE "RA"
2 WAY
500 Mcm

G&W Type "RA" Oil Disconnects use the ROCKER ARM operated links with full floating contacts. Stationary contacts are attached to the connector hood nuts which seal the cable pothead porcelain insulators.

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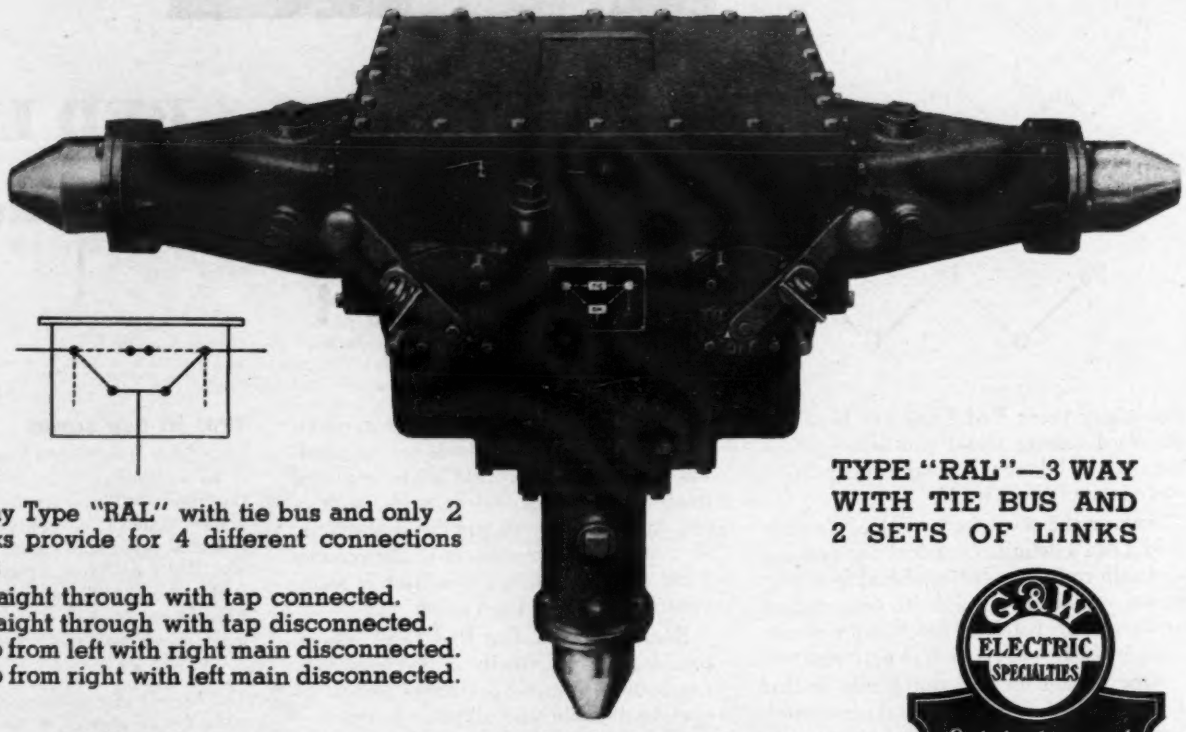

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- The 3 way Type "RAL" with tie bus and only 2 sets of links provide for 4 different connections of circuits:

1. Feed straight through with tap connected.
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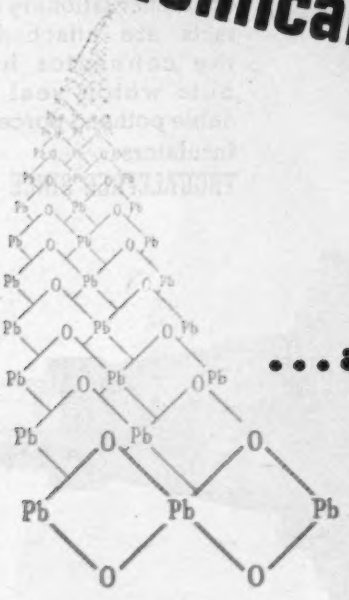

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Among the most important of these is Red Lead's definite chemical composition and uniformity—as distinguished from pigments which have indefinite composition or vary from batch to batch, with resulting possibility of variation in performance.

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Uniform composition means dependable performance, day after day, job after job.

Furthermore, Red Lead has the property of counteracting acid conditions, recognized as accelerators of rust. In the presence of various acids, Red Lead forms insoluble neutral lead salts at the approximate rate at which the acids are supplied. This is true whether the acids originate from acid forming environments, such as gas, smoke and moisture in the atmosphere, or from the decomposition of the vehicle. Thus, a rust inhibiting condition is maintained with a Red Lead paint.

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The value of Red Lead as a rust preventive is most fully realized in a paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint. No matter what price you pay, you'll get a better paint for surface protection of metal, if it contains Red Lead.

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"Red Lead in Corrosion Resistant Paints" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior protection. It also includes typical specification formulas. If you haven't received your copy, address nearest branch listed below.

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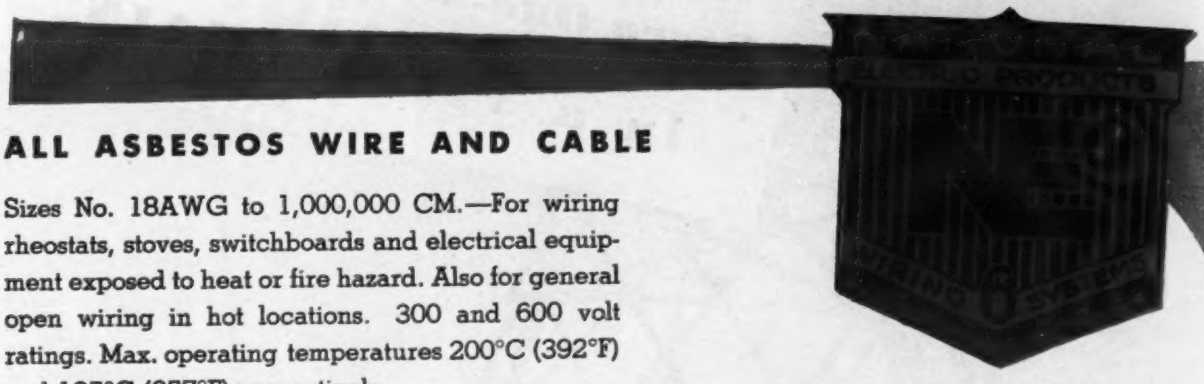
For HOT SPOTS use "Easbestus" WIRES and CABLES

A name to remember for installations where heat, flame, oil, moisture, grease and corrosive fumes prevail, and where rubber, Neon (thermoplastic) and varnished cambric insulations are unsuitable.

Illustrated are two examples from our wide range of asbestos and asbestos-varnished cambric insulated wires and cables. Literature and complete engineering data on request.



ALL ASBESTOS WIRE AND CABLE

Sizes No. 18AWG to 1,000,000 CM.—For wiring rheostats, stoves, switchboards and electrical equipment exposed to heat or fire hazard. Also for general open wiring in hot locations. 300 and 600 volt ratings. Max. operating temperatures 200°C (392°F) and 125°C (257°F) respectively.

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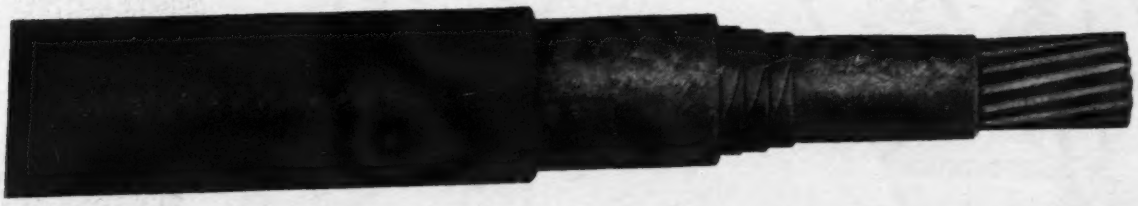
Sizes No. 18AWG to 1,000,000 CM.—For power circuits and general hot spot wiring in boiler rooms, steam tunnels, etc. 600 to 8000 volt ratings. Max. operating temperatures 110°C (230°F) and 91°C (196°F) respectively.



National Electric
PRODUCTS CORPORATION
Pittsburgh, Pa.

Electrical World
MAY 12, 1945

Responsibilities of Victory

V-E MEANS MORE than victory in Europe. It eans the defeat of a totalitarian concept of vernment that if victorious would have nketed the earth. However, its seeds can ain take root unless we are conscious of our sponsibilities as victors.

Such responsibilities attach not only to tions but to individual parts thereof, both oples and industries. To the extent that they n prevent any condition arising which would use the public to be willing to give up some edom in return for security, so much is their sponsibility.

Few industries can contribute more in this rection than the electric light and power com- nies. They can contribute both by helping to prove the general public economy and by king private ownership more desirable in the nds of people.

People will not want security provided by vernment if there is work to be had and living nditions are gradually improving. To this d all industries must join, and the electric lity industry, by having a vision larger than ever had before, can contribute greatly. If it ll set a sales goal based upon vision it will eate greater employment than ever before in manufacture and sales of the current-using uipment. But more than that it will be helping improve the standard of living.

More power per worker in the factories means wer cost of production that can be reflected in purchasing power of the dollar. Better ectrically furnished homes mean definitely tter living conditions. Improved lighting alone roughout the country would contribute greatly production, safety, health and education.

Before the war the people had turned many times to government for relief because they had lost confidence in business. Manufacturing has shown its tremendous capabilities in its record of war production and certain industries like the railroads have created a great public confidence by virtue of their magnificent performance.

The electric utility industry, on the other hand, in spite of an equal if not better war performance, is still open to attack and since it seems to provide the most popular area in which to set up socialized projects it would appear that the industry has a large responsibility to provide an atmosphere around utility operations that makes socialized power unattractive.

Before the public can have confidence in any business it must have confidence in itself and be willing to work with others in the business. The electric utility industry does not enjoy that condition today. More than ever, it must be organized strongly nationally, not into several small groups as today, and be willing to submerge individual prejudices in favor of industry good. Then perhaps it can agree on a strong national power policy and can sell itself to law makers and to the public.

At the same time, confidence in the industry must be built up among the employees. Employee indoctrination; substitution, wherever possible, of the merit system for seniority; better understanding with labor on mutuality of interest; and introduction of new young blood into companies will be found to be helpful.

If we have been fighting for freedom from regimentation and if victory is to mean anything then these responsibilities are real. There is nothing new in them, except a new opportunity.

Power Supply for Chinese Industrialization Program

Immediate postwar program calls for 900,000 kw. of steam plants in provinces to serve 711 industrial plants located in 107 communities

Some 538 miles of transmission involved

A. E. KNOWLTON, Associate Editor "Electrical World"

CHINA HAS A FIVE-YEAR PLAN for industrialization and civic betterments which has been prepared by engineers of the National Resources Commission for China. Engineers of our own Foreign Economic Administration have collaborated in shaping the plan; this program was directed by Alex Taub; Robert F. Hamilton is the author of the report on "Power" which is Volume 5 of a "Guide to the Industrialization of China" prepared by FEA. From this report has been extracted the following information of likely interest to American electrical engineers in manufacturing and industrial establishments.

Objective is to motivate the industries suggested by FEA engineers toward a balanced program for starting China on the path to becoming an industrial nation as soon as possible after establishment of peace with Japan and the formation of a strong central governmental control over all of China. The immediate task is to set the program in motion with fuel-power electric plants long before any hydro program (e.g. the Savage plan described in ELECTRICAL WORLD news, March 17, 1945, page 97) can be functioning. In fact, except for a few small developments in the vicinity of Chungking and Kweichow the preliminary hydro surveys have not even been started. This fact coupled with the expressed desire of the Chinese representatives in the United States to develop their coal mining and coal consumption to the fullest extent, has led to the omission of hydro developments in the immediate recovery program except for about 10,000 kw. in three small developments.

TABLE I

Power Demands and Consumptions for Industrial Plants

(89 of the plants will require a total of 3,700,950 pounds of process steam per hour)

Industry Classification	Number of Plants	Total Demand Kw.	Annual Consumption Mwh.
Mining and metallurgy	170	184,885	1,039,075
Chemical	105	187,700	1,181,610
Industrial	192	179,425	812,650
Agricultural and Miscellaneous	244	34,600	119,700
Totals	711	586,610	3,153,035

All the other plants proposed are assumed to be coal burning plants. Later, Diesel-engine generating units may be determined as preferable in some locations where small units would be indicated.

Scope

Proposed for the two-year industrial expansion program are 711 separate undertakings in 127 different types of industrial enterprises requiring power for their operation. As indicated in the accompanying Table I, it is estimated that they will require 586,610 kw. of generating capacity and consume over 3 billion kw.-hr. annually. Of these 526 have been tentatively located (see map and tabulation) in 107 communities as far west as the Chungking region. It is contemplated to place the generating stations and industrial plants so that distribution can be at generator voltage of 13.8 kv. or less. Longer range plans of Chinese engineers will involve more transmission at higher voltages.

Power losses at the maximum were taken at 10 percent because of the comparatively short distribution distances involved. Where distances run higher the loss allowance was taken as 17 percent (4 percent constant and 13 percent for variable) at the peak.

Steel Plant Located

Chinese engineers of the National Resources Commission, in their 5-year program, contemplated adding 40,000 kw. to Tayeh and 100,000 kw. in Wuchang. The FEA engineers have tentatively located the largest steel plant in Tayeh since that seems the logical location for a large modern power plant of 300,000-kw. ultimate capacity in six 50,000-kw. units.

At eleven separate and widely scattered points high tension transmission lines are proposed. They total 538 miles of which 146 miles is 132 kv. (see Table III and map). The lines are quite tentative and their installation, as well as choice of voltage and carrying capacity, will hinge considerably on the prospects of future loads and generating capacities.

Program 900,000 Kw.

In all, the FEA recommendations involve the installation of about 900,000 kw. and this is quite independent of the Chinese National Resources program of 1,838,000 kw. in 5 years after cessation of hostilities. Before the Japanese invasion the Chinese as a nation had about 2 watts of generating capacity per inhabitant as the United States figure is about

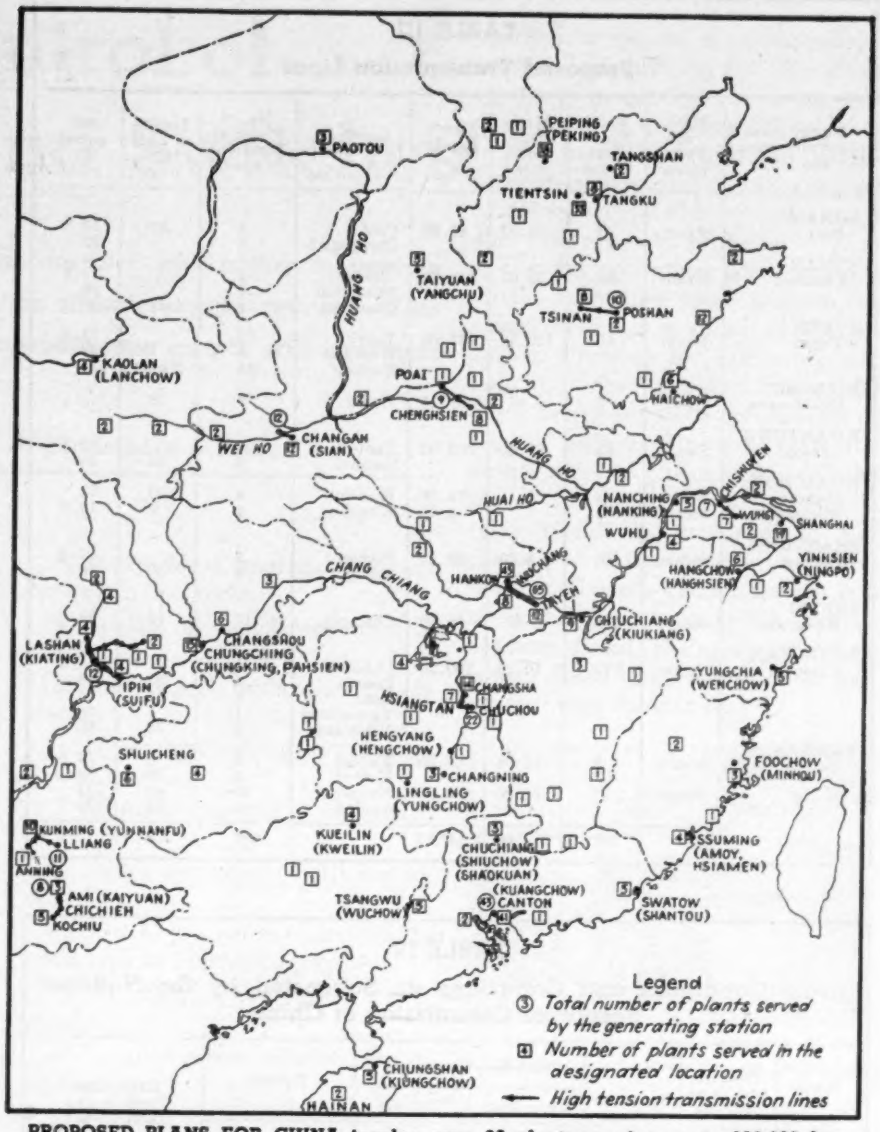
watts per inhabitant). This was represented by 858,820 kw. of which 331,861 kw. was in factories. Of the remainder, 206,158 kw. was Chinese private power, 47,540 kw. government owned and 273,262 kw. of foreign ownership. Exclusive of Manchuria there were 460 plants of which only 15 were larger than 10,000 kw. Hydro was negligible in amount. In Manchuria under Japanese development there were 721,500 kw. Two hydro sources (360,000 kw. and 450,000 kw.) have been developed there recently.

The National Resources Commission of China has compiled information on 16 hydro projects on which some work has been done.

Frequency Question

In 1929 fifty-cycle frequency was adopted officially as the standard frequency for the country and most of the recently installed equipment is of that frequency. The recent installations in the Chungking area are, however, 60-cycle. In view of the pre-war preponderance of 50-cycle equipment there was a disposition to favor 50 cycles for the expansion program. Awareness of the fact that many of the present facilities will undoubtedly be destroyed by the Japanese as they retire plus the recognized merits of 60-cycle frequency has led the Chinese engineers to be more favorable toward a complete shift to 60 cycles.

It was pointed out that 60-cycle frequency is better for fluorescent lighting, requires less iron for motors and transformers, lets capacitors weigh and cost less. Turbine-generators run faster and weigh less, cost less and have better water rates. Differences in favor of 60-cycles for hydro-generators are admittedly narrower. Fifty cycle admittedly shows some superiority in transmission, particularly for the longer distances, as to both voltage regulation and stability.



PROPOSED PLANS FOR CHINA involve over 90 plants ranging up to 129,000 kw. of industrial load demand. Fourteen plants are over 10,000 kw.

TABLE II

Summation of Proposed Electric Loads by Provinces

Provinces	Number of Plants Served	Total Kw. Demand at Plants	Total Mwh. Yearly at Plants	Total Kw. Generating Peak Loads	Total Mwh. Generating Station Output
Anwhei	10	6,220	33,850	6,720	37,520
Chahar	4	4,550	16,000	5,050	16,720
Chekiang	14	10,000	65,050	10,594	74,657
Fukien	10	2,100	7,150	2,067	7,731
Honan	15	12,220	50,940	12,786	54,782
Hainen Island, Kwg	7	14,400	58,000	15,816	60,820
Hopeh	66	88,525	456,530	91,539	499,901
Hunan	43	36,795	158,790	37,493	172,057
Hupeh	68	127,700	671,630	130,852	738,759
Kansu	10	5,000	20,800	5,245	22,250
Kiangsi	22	6,560	29,450	6,861	31,703
Kiansu	42	26,875	161,000	29,244	179,306
Kwangsi	14	5,320	22,450	5,424	23,846
Kwangtung	52	37,700	197,170	38,887	220,624
Kweichow	14	19,870	89,805	22,631	97,950
Shansi	9	11,580	61,410	12,117	66,470
Shantung	27	17,625	76,150	18,399	82,365
Shensi	16	11,390	65,250	11,299	73,350
Suiyuan	3	3,200	18,300	3,296	20,750
Szechwan	53	36,520	203,240	37,678	228,018
Yunnan-Sikang	27	91,810	654,620	106,783	725,840
Total Located	526	575,960	3,117,585	610,781	3,435,419
Various not located	185	10,650	35,450	10,650	35,450
Totals	711	586,610	3,153,035	621,431	3,470,869

Turbines and Transformers

Specifically with regard to turbines one American manufacturer supplied FEA with a statement as follows:

"To most efficiently utilize a given B.t.u. drop the summation of blade velocities squared must in either case be made substantially equal, meaning

TABLE III

Proposed Transmission Lines

Supply Point Province and City	Steam or Hydro Power	Total No. of Plants Served	Maximum Load Mw.	Yearly Energy Mwh.	Locations Served	No. of Plants at Locations Given	Length of Line Miles	Suggested Kv.
HONAN								
Poai	Steam	9	10.32	45.80	Poai	1	22	13.8
					Chenghsien	8		66
HUNAN								
Chuchou	Steam	22	30.22	136.70	Chuchou	1		13.8
					Hsiangtan	7		66
					Changsha	14	45	66
HUPEH								
Tayeh	Steam	65	129.35	734.00	Tayeh	12		13.8
					Wuchang	8		13½
					Hankow	45	2 x 53	132
KIANGSU								
Chi-shu-yen	Steam	7	5.98	37.15	Wuhsi	7	18	....
KWANTUNG								
Canton	Steam	43	35.00	203.00	Canton	41		13.8
					Sanshui	2	30	33
KWEICHOW								
Hsuwen	Hydro	4	3	14.00	Kueichu	4	20	33
Kueichu	Steam	4	1	4.60	Kueichu	4	0	13.8
SHANTUNG								
Poshan	Steam	10	8.03	36.20	Poshan	2		13.8
					Tsinan	8	50	66
SHENSI								
Hsienyang	Steam	12	8.59	66.20	Changan	12	15	33
SZECHWAN								
Chienwei	Steam	12	16.26	100.20	Chienwei	1		13.8
					Loshan	4	30	66
					Ipin	4	50	66
					Tzuliuching	1		66
					Neichiang	2	75	66
YUNNAN								
Kaiyuan (Ami)	Steam	8	65.05	506.00	Kaiyan	3	0	13.8
					Kochui	5	22	33
Iliang	Steam	11	36.20	183.50	Kunming	10	40	132
					Anning	1	15	33
Total		207	349.00	2,067.35		207	538	

TABLE IV

Steam Conditions and Capacities as Suggested by the National Resources Commission of China

Nominal Capacity Kw.	Pressure and Temperature at Throttle	Generator Voltage	Turbine—Generators		Boilers	Extraction Pressure and Temperature
			Generators	Turbines		
			Max. Cont. Cap.	Max. Cont. Cap.	Max. Cont. Cap.	
1,000	400 Psi.	6,900 v.				
2,000	750 F.					
5,000	400 Psi.	6,900 v.	5,000 kw 0.80 PF.	6,250 kw.	1-80,000 lb/hr.	170-225 F.
	750 F.	13,800 v.	6,250 kva.			6-19 Psi. Abs.
10,000	400 Psi.	13,800 v.	10,000 kw. .80 PF.	12,600 kw.	2-80,000 lb/hr.	170-225-290 F. 6-19-57 Psi. Abs.
	750 F.		12,500 kva.			
20,000	850 Psi.	13,800 v.	20,000 kw. .80 PF.	25,000 kw.	2-160,000 lb/hr.	170-225-290 F. 6-19-57 Psi. Abs.
	900 F.		25,000 kva.			
50,000	850 Psi.	13,800 v.	50,000 kw. .80 PF.	62,500 kw.	2-400,000 lb/hr.	170-225-290-350 F. 6-19-57-135 Psi. Abs.
	900 F.	34,500 v.	62,500 kva.			

roughly that for 5/6 the speed we would theoretically require 44 percent more rows of blading on the same diameter (for 50 cycles) or 20 percent greater diameter with the same number of rows. . . . In any case increase in weight and cost will be 20 to 25 percent. . . . We would expect efficiency to be lowered on an average of 3 to 4 percent."

As for transformer voltage drop—

"While it might first appear that a given transformer operated at 60 cycles might have a lower voltage drop, when expressed as a percentage, such is not the case. If a given 60-cycle transformer were operated on 50 cycles the voltage rating would be only 5/6 as great as the 60-cycle rating. Leaving the current the same the voltage drop in the transformer would likewise be 5/6 as great. . . . Since both the rated voltage and the voltage drop have been reduced in the same proportion the percentage drop remains the same. . . . Losses for the same flux density are smaller in absolute value for 50-cycle operation but larger expressed as a percentage of kva. rating."

Chinese Standards

Tentative engineering standards have been adopted by the Chinese National Resources Commission. These fix on 220, 132, 66 and 33 kv. for transmission and 33,000, 13,200, 6,600 and 380/220 volts for distribution. Three-phase distribution transformer kva. ratings are 10, 20, 50, 100, 200, 500, 1,000, 1,500 and 2,000; single-phase kva. are 2, 5, 10, 20, and 50. Three-phase transmission and network transformers are set up in 13 sizes ranging from 500 to 50,000 kva. Motor voltages are 220, 6,600 and 13,200 for three-phase. Single-phase watthour meters are rated 1.5, 3, 5, 15 and 50 amp.; three-phase, 5, 15, 50 amp. Voltages for d.c. equipment are 32 and 110 (both for station control), 220 and 440.

Steam pressures at turbine throttle are 250, 400, 650 and 850 psi., temperatures 675, 750, 825 and 900 deg. F. Table IV shows the steam station standards as suggested. These may be modified to conform to the new AIEE-ASME standards.

•

Limited Heavy-Wall Pipe Standards Would Cut Cost

Utilities could secure heavy-wall large diameter, seamless pipe, used for high-pressure steam mains connecting boilers within turbines, at a lower price if they would agree to adhere to a limited number of standard sizes with regard to outside diameter, wall thickness, and length. This was indicated by E. C. Wright, assistant to the president of the National Tube Co., in the Bulletin of the American Society for Testing Materials.

Because of constantly changing standards, manufacturers are unable to stock such pipe. The result is that each order is specially made, and the cost is often ten times as much as that of regular piping because of the time and trouble the mills must take to produce the billets and the pipe itself.

Remote Control of Underground Switches

Scheme provides operator with ability to operate and check position of underground switches—Uses pilot wires—Sectionalization on par with overhead

GEORGE S. VAN ANTWERP, Philadelphia Electric Co.*

MANUAL CONTROL of underground switches by a scheme developed for the network area places the reliability and rapidity of sectionalizing underground on a par with overhead lines. This reliability is obtained by eliminating batteries from the manhole and supplying the motor of the motor-operated switch over an independent circuit from the substation. Speed is achieved by making it possible to check all switch positions and to perform all switching operations at the substation; this is done over pilot wires.

The prerequisite for the successful planning of this scheme involved the following:

1. Sufficient number of manhole switches to sectionalize the cable.
2. Switches provided with motor operating mechanisms.
3. Independent source of power for switch operation.
4. Control of switch operation at substation.
5. Answer-back indication to operator.
6. Means of checking switch position at any time.
7. Minimum amount of equipment in manhole.
8. Switch mechanism easily disconnected.
9. Switch mechanism applied to usual type of manhole equipment.
10. Manhole equipment waterproof.
11. Control panel switches shown on diagram.
12. Control panel with simple foolproof switching-sequence.

Three control wires plus the motor's independent supply are the only conductors needed for the substation operator to cut out a cable fault by sectionalizing the circuit. The cable can then be re-energized leaving only that section in the immediate vicinity of the fault unserved. This brings restoration of service on underground primaries comparable to that obtainable with overhead primaries.

The red and green position lights on the substation panel indicate the closed or open position of the oil switch. Previous to performing any switching the operator closes the check switch verifying the position of the oil switch. He then dials the switch number on an ordinary telephone dial which closes the selector relay circuit in the manhole and causes a white light to glow on the station panelboard. The white light is a check that the correct switch number has been dialed. The operating switch is then closed which energizes the motor-operating mechanism.

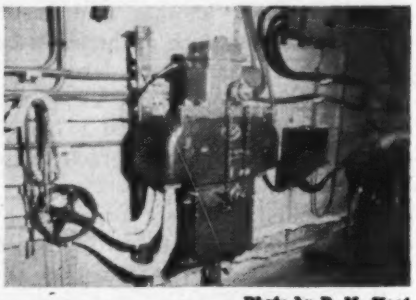


Photo by R. M. Hoot

FIG. 2—Switch installed in manhole

The motor, upon receiving power from the closing power relay, operates the switch. The associated auxiliary switch stops the motor after operating the oil switch, reverses its direction and also reverses the position of the switch in the colored lamp circuit. The operator is then able to check the oil switch position by closing the check switch.

Development of the system resulted from a staged test which assumed a cable failure and took into account all the prior routine necessary to call troublemen, open the manholes, operate the switches, keep the load dispatcher informed and finally arrange for secondary interconnection on the section assumed to be in trouble. That test was performed under favorable conditions (little traffic or parking, clear weather and no ice) but took too long to be considered good operating performance. The pilot scheme is definitely superior as an alternative.

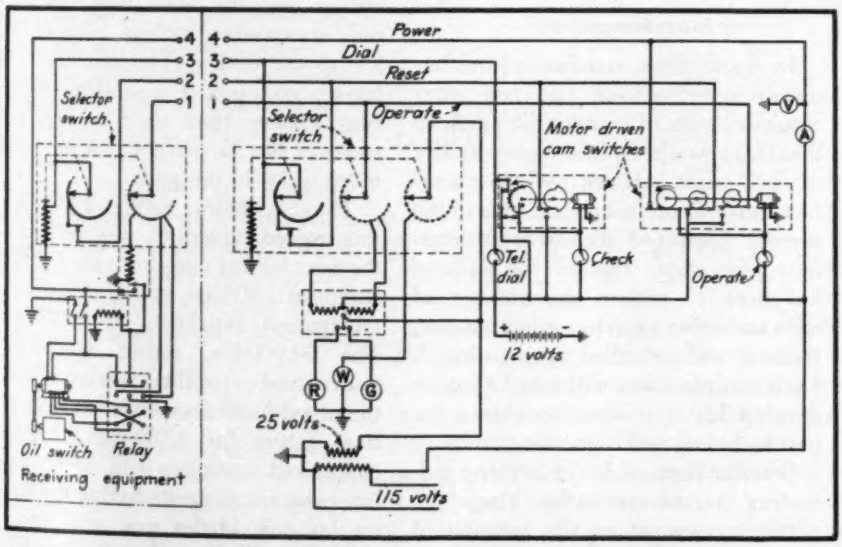


FIG. 1—Schematic diagram for remote control by impulses and pilot wires

*General Superintendent of Transmission and Distribution Departments.

A.I.E.E.–A.S.M.E. Standards for Turbo-Generators Explained

Discussion of factors considered and conclusions reached in effort to achieve unified program of ratings, extractions, interchangeability, marginal generator capability, power factor and short circuit ratio—Specification data also standardized

M. S. OLDACRE, Chairman A.I.E.E. Group, Joint A.I.E.E—A.S.M.E. Committee

PREFERRED STANDARD for large 3,600-rpm. steam turbine-generators recently approved by the A.I.E.E. and A.S.M.E. mark another step in the standardization work of the electrical industry. These new standards apply to units rated from 11,500 kw. to 60,000 kw. and are intended to supersede the present industry practices for rating of units.

The standards were prepared by a Joint Committee of the two societies. They are based on information and advice received from the users of over half of the steam turbine-generator capacity in the central station industry. In addition, they have been discussed at various technical committee meetings to obtain the viewpoint of as many engineers as possible. This method of free discussion before adopting a new standard follows the usual practice of the American Standards Association and similar organizations in establishing acceptable standards for any industry. It has the advantage of considering the needs and limitations of both the manufacturers and users.

Scope and Latitude

The new standards, which are shown in the table, are intended to provide standard units that will fit practically all needs. It is expected that there should be reductions in engineering and manufacturing costs, that will help to reduce the total cost compared with present-day practices, of generating stations.

The standards are not intended to interfere with building special-characteristic machines when they are needed or with the duplication of existing machines for which designs, patterns, etc., are available, but the purchaser of the standard units will obtain benefits not necessarily available to the purchaser of the non-standard unit.

Adoption of the standards is not intended to cause a reduction in research and development work. On the contrary, it is hoped that the reduction in the number of special designs will allow more time for such work. As stated in the foreword to the standards, they are intended to be progressive standards and to permit technical and economic development consistent with the fundamental purpose of expediting production and installation of steam-electric generating equipment.

Interchangeability

In many cases, standardization has meant agreement on size and other characteristics of component parts, so that there would be interchangeability of such parts between various manufacturers. There is no such idea in the present preferred standards for turbine-generators. Instead, the purpose has been to reduce the number of sizes and other variations that a manufacturer will be called upon to build. Each manufacturer will thus be free to develop his own ideas to obtain the best technical and economic results.

Standardization of the turbine-generators started out rather simply to obtain agreement on the location of the openings to extract steam for feed-water heating. It was soon observed that there were real possibilities of benefit to all concerned if a group of preferred ratings could be established. The Joint Committee on Turbine-Generators was then formed.

Turbine Standards

Turbine-generator units in the 500 to 7,500-kw. sizes have been quite well standardized for some time, but development changes in the larger units have been frequent enough that it has been difficult to establish standards for the entire industry. However, design and operating practices for the larger 3,600-rpm. machines now justify standardization in rating of these machines.

In the past, there have been ten ratings from 10,000 kw. to 60,000 kw. for condensing-type 3,600-rpm. machines, but the new standards have only six standard ratings, from 11,500 kw. to 60,000 kw. The machines will have a guaranteed capability 10 percent greater than their ratings, instead of the 25 percent that has been more usual in the past.

The 11,500-kw. rating, 12,650-kw. guaranteed capability, was selected as the next logical one above the existing standard 7,500-kw. rating which has a guaranteed capability of 9,375 kw. The 60,000-kw. rating, 66,000-kw. guaranteed capability, was considered the maximum economical and practical rating for 3,600-rpm. tandem-compound machines with double-flow low-pressure elements having the largest last-row blades now available.

There will be only one standard

n condition for each of the four ller ratings, while there will be a ce of two steam conditions for the larger ratings. Thus there will be eight standard designs for the en- range from 11,500 kw. to 60,000

A comparison with past practice reveal the great reductions in the ber of designs that were con- red available from the manufac- rs. Most of the machines could be ined for pressures of less than psig. up to 1,450 psig., with a e range of steam temperatures and aust pressures that might be speci- . Actually, the steam pressures e grouped in four ranges—up to psig., 451 to 650 psig., 651 to 850 ., and 851 to 1,450 psig. Also, the perature limits for a particular e of construction were in five ups—for steam temperatures up to deg. F., then 825 deg. F., 900 deg. 950 deg. F., and 1,000 deg. F. Con- ering only pressure and tempera- limitations, there might be 141 ic constructions. To this should be ded the changes caused by varia- n in exhaust pressure, and number d location of extraction openings feed-water heating.

Extraction Openings

The extraction openings are now finitely specified as to number and saturation temperature of the am that will be used for feed-water ating. It is obvious that this will plify the engineering work by the nufacturer and eliminate the varia- n in design if the extraction con- ions are varied.

The standard design will be based an exhaust pressure of 1.5 in. (28.5 in. vacuum). It is expected that standard machine can be used suc- ssfully for other exhaust conditions, without necessity of attempting a spe- al design to give theoretically ideal erformance.

Restricted number of standard eam conditions should be found ad- ntageous in standardizing boilers, uperheaters, and other station auxili- ries, thus presenting further possi- ilities for reduction of generating tation costs.

New Power Factor Rating

One of the outstanding changes rom the electrical engineer's view- oint is in the power factor rating of he generator. The new standard is 0.85 as compared to 0.80 of past practice.

Data obtained by the committee from users indicated that there was a considerable lack of coordination in the past between maximum capabilities of the turbine and the generator of a combined unit. The difficulty lay in the fact that the generator power factor of 0.80 was based on the nameplate rating of the turbine. This gave a generator capability 25 percent higher than its kw. rating. But the turbine's guaranteed capability of 25 percent above nameplate used up all this margin in the generator. This often resulted in a unit that had little or no reactive capability at maximum turbine capability so that maximum kilowatt output could be obtained only by operating the generator at 1.00 power factor. Usually this could not be done without adding power factor correction equipment.

Marginal Capability

Data from the industry indicate that the generator kva. rating should be about seven percent greater than the guaranteed capability of the turbine. This would make possible generator load power factors corresponding to usual conditions at times of heaviest load. At first glance the change in rated power factor of the generator would seem to be in the wrong direction. However, the change in maximum turbine capability is in the other direction and the two changes give coordinated turbine and generator capabilities which most nearly fit the requirements of the industry. A comparison of two machines under the old and the new standards illustrates this point:

Basis of Rating	Unit Rating Kw.	Turbine Guaranteed Maximum Capability Kw.	Generator Rating		Operating P.F. at Guaranteed Maximum Capability	Ratio: Generator Kva. / Turbine Guaranteed Capability
			Kva.	P.F.		
Old	35,000	43,750	43,750	0.8	1.00	1.00
New standard	40,000	44,000	47,058	0.85	0.935	1.07

One of the design characteristics of the generator that affects the size of the machines is the short-circuit ratio. Decreasing the short-circuit ratio permits a reduction in the dimensions and amount of material and therefore in the cost of the generator.

Possibility of using a lower short-circuit ratio than the previously used value of 0.9 was investigated by the committee. Machines have been built with short-circuit ratio ranging from 0.5 to over 1.0. Information sent to the committee showed that there was no actual problem of instability with generators having less than 0.9 short-circuit ratio. Two or three cases were cited where machines had pulled out of step, but in every case there were contributing factors in the manner in which the generator was operating that explained the troubles that may have occurred. Furthermore, there are machines of 0.5 to 0.6 short-circuit ratio that have operated for over fifteen years without exhibiting instability.

The real question is the pull-out torque capability of the unit. On the basis that the machines built in the past have operated satisfactorily, it was concluded that the new standard generators should have substantially the same pull-out torque as the present-day machines.

Pull-out Torque

It was found that the generator rated 0.85 power factor and 0.8 short-circuit ratio in the new standards had practically the same pull-out torque as the older machines rated 0.80 power factor and 0.9 short-circuit ratio. Furthermore, the reduction in materials and cost by using 0.8 short-circuit ratio generators just about offsets the cost of the increase of seven percent in the kva. rating of the generator, as described above.

The two smaller units are specified with air-cooled generators, while the four larger ones have hydrogen cooling. At the present state of development, the 20,000-kw. unit is considered the smallest that can economically use hydrogen cooling.

Hydrogen Cooling

Hydrogen-cooled generators are rated on the basis of operating at 0.5 psig. hydrogen pressure. The units are to be designed for use at higher pressures up to 15 psig. All necessary equipment for operation at the higher pressure is to be included with the unit and it will be necessary to only adjust the regulating valves. Operation at the higher hydrogen pressure will make available 15 percent greater kva. capability at rated power factor from the generator without exceeding guaranteed temperature rise. This ad-

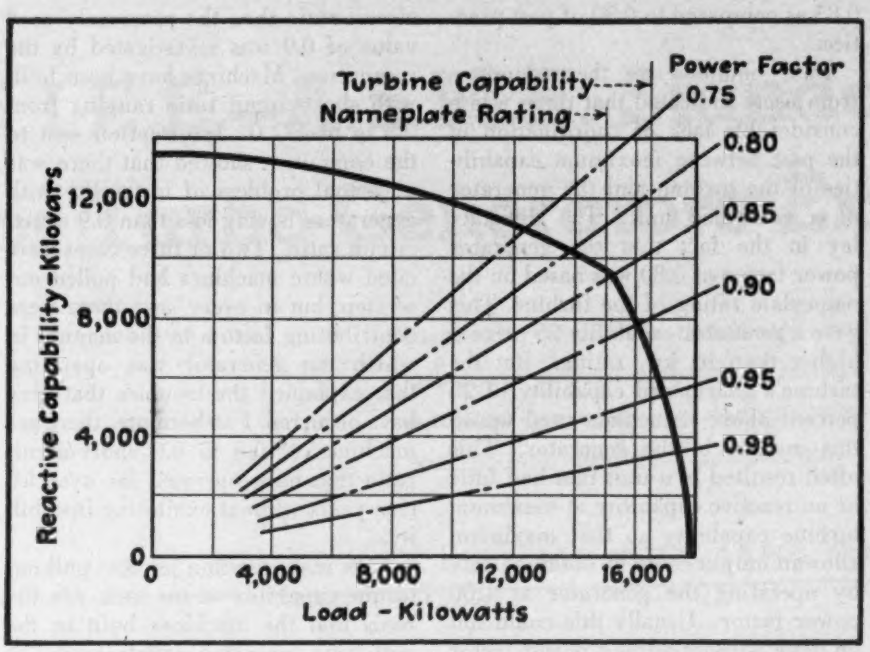


FIG. 1—Reactive capability of air-cooled generator rated 15,000 kw. at 0.85 p.f.

ditional kva. capability can be utilized to carry greater kva. load at lower power factor, or, for any given load, the generator will operate at a lower temperature. The hydrogen gas consumption will be slightly higher at the higher pressure.

Present developments in generator design did not warrant basing the standards on generator operation at 15 psig. hydrogen pressure. It was considered best to utilize the additional capacity at the higher pressure for carrying kva. load greater than that of the normal generator rating.

Data for Generators Standard Specification

In addition to functioning as part of the Joint Committee on Steam Turbine-Generators, the A.I.E.E. Group prepared "Standard Specification Data for Generators for Large 3,600-RPM. 3-Phase 60-Cycle Condensing Steam Turbine-Generators." The Specification Data have been approved by the Board of Directors of the A.I.E.E.

It is intended that the Standard Specification Data will eliminate so of the variations in construction tails that the manufacturers h found to be an important element the cost of the machines. Any s plification should be reflected in purchase price of the machine.

Operating voltages of generators various power plants cover such wide range that it is impossible specify one standard voltage for generators; hence, four values h been included which will provide the needs in about 95 percent of cases. The voltage question is bei investigated by a Joint E.E.I.-NEM committee and when a decision h been reached the A.I.E.E. Group the Joint Committee on Turbine-Ge erators will undoubtedly make su able recommendations. Obviously, o generator voltage, say of 13.8 kv, would be ideal for the designer an manufacturer. However, the use the voltages of approximately 11. kv., 12.5 kv., and 14.4 kv. is comm enough to require their continue availability.

Reactive Capability

Specification Data include informa tion regarding the reactive capabilit of the generators that seemingly wil be of considerable value. It has been explained above that a larger genera tor in proportion to the turbine ca pability is required. This has been provided, but the next question is how

Preferred Standards for Large 3,600-RPM., 3-Phase, 60-Cycle Condensing Steam Turbine-Generators

	Air-Cooled Generator		Hydrogen-Cooled Generator—Rated for 0.5 Psig. Hydrogen Pressure			
1. Turbine-generator rating — kw	11,500	15,000	20,000	30,000	40,000	60,000
2. Turbine capability — kw	12,650	16,500	22,000	33,000	44,000	66,000
3. Generator rating — kva	13,529	17,647	23,529	35,294	47,058	70,588
power factor	0.85	0.85	0.85	0.85	0.85	0.85
short-circuit ratio	0.8	0.8	0.8	0.8	0.8	0.8
4. Throttle pressure — psig	600	600	850	850	850 or 1,250	850 or 1,250
5. Throttle temperature — F	825	825	900	900	900 or 950	900 or 950
6. Number of extraction openings	4	4	4	5	5	5
7. Saturation temperature at	1st 175	175	175	175	175	175
8. openings at	2d 235	235	235	235	235	235
9. " turbine-generator rating "	3d 285	285	285	285	285	285
10. with all extraction	4th 350	350	350	350	350	350
11. openings in service — F	5th ...	...	...	410	410	410
12. Exhaust pressure — in. Hg abs.	1.5	1.5	1.5	1.5	1.5	1.5
			Hydrogen-Cooled Generator — Operated at 15 Psig. Hydrogen Pressure			
13. Generator capability at 0.85 power factor — kva	.....	.....	27,058	40,588	54,117	81,176

Notes: (1) A tolerance of plus or minus 10 deg. F. shall apply to above saturation temperatures. (Tolerances shall be unilateral so as not to reduce the spread in temperature between adjacent extraction openings.)

(2) " Turbine capability " is guaranteed continuous output at generator terminals when the turbine is clean and operating under specified throttle steam pressure and temperature and exhaust pressure, with full extraction from all extraction openings.

much reactive capability is available at any load on the machine. A curve applying to each of the standard generators has been included in the Specification Data. Two of the curves are included in this article: Fig. 1 shows the reactive capability for an air-cooled 15,000-kw. generator, and Fig. 2 shows similar data for a hydrogen-cooled 40,000-kw. generator. The curves show the reactive capability of the generators at various loads without overheating or overloading the rotor or stator windings. The reactive capability provided in the new designs meets the needs of the usual power stations and also of stations where the generators may operate essentially as synchronous condensers floating on the line but ready to pick up power load whenever needed.

Specification Data recommend that coolers for air-cooled generators be included as part of the generator. Air coolers are now provided for the majority of the machines, and the committee concluded that definite overall savings could be made if the coolers were essentially part of the generator, although not built into the generator frame, as in hydrogen-cooled generators. The standard cooler design will be based on 90 deg. F. cooling water and for a working pressure of 50 psig., but provisions will be made so that special coolers to use cooling water of 95 deg. F. or for higher working pressures can be supplied. In certain areas of the country, cooling water at a temperature of 95 deg. F. is encountered for long periods of time, but such conditions can be cared for easily by larger coolers without burdening all plants with the extra cost of a larger cooler that may not be needed. The piping arrangements in some plants are such that the coolers may be subjected to higher water pressures than in others where 50 psig. is the upper limit. The few cases where such conditions exist can be cared for with special coolers.

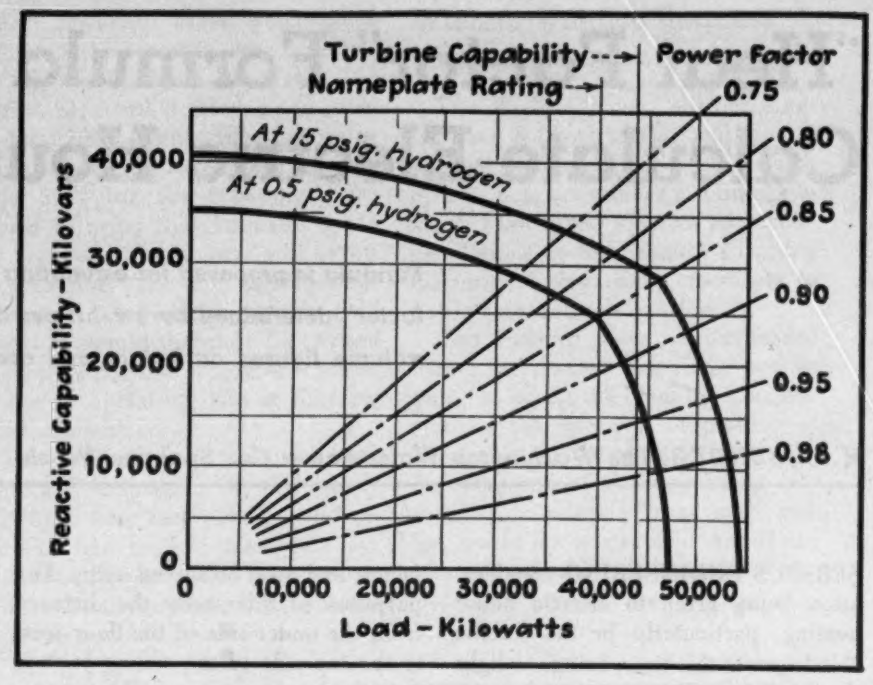


FIG 2—Reactive capability of a hydrogen-cooled generator rated 40,000 kw. at 0.85 power factor and 0.5 psig. hydrogen pressure

Hydrogen Coolers

Hydrogen coolers present a little different problem as they are built integral with the generator frame. If higher-temperature cooling water is used in the standard cooler, increased cooling effect can be obtained by increasing the hydrogen pressure slightly. It is estimated that about 2 psig. increase will compensate for an increase in cooling water temperature from 90 to 95 deg. F. This is a much more economical method than to make provision in the generator frame for the larger cooler that may be required in a few cases.

For installations where working pressures of the cooling water range from 50 to 125 psig., provisions have been made to receive coolers suitable for 125 psig.

The standard design of excitation system is based on a shaft-driven exciter with shaft-driven pilot exciter. At the present time most machines are sold with the shaft-driven exciters, and the specified characteristics are for such machines. However, when desired, the shaft-driven exciters may be omitted without altering the standard turbine-generator.

The committee considered very carefully the extensive information that it received, and prepared the recommendations to meet the expressed needs of a large majority of users. The committee recommends that purchasers utilize one of the standard rated and constructed machines and, by doing so, increase the proportion of standard machines that are built, with consequent benefit to the industry as a whole.

• • •

Lightning Functions as Nitrogen Fertilizer

Maximum electrical energy that could be obtained from the two billion lightning strokes that annually bombard the total earth's surface is approximately 175 billion kilowatt-hours per year, according to G. D. McCann of Westinghouse.

A stroke can momentarily produce upwards of 200,000 amp., enough current to light two hundred thousand 100-watt light bulbs, or a city of about 30,000 population. However, it could only do this for a fraction of a second.

At the same time, lightning serves two very useful purposes, by releasing nitrogen from the air and by charging the earth's crust with electricity.

Action of the thunderbolts through the atmosphere releases nitrogen from the air and, the form of nitric acid, the nitrogen falls in rain drops and enriches the soil.

"In this way," Dr. McCann points out, "lightning annually produces nearly 100 million tons of nitric acid—more of this soil-builder than is manufactured by all the world's fertilizer plants."

"Heat Factor" Formula to Calculate Electric House Heating

Formula is proposed for estimating energy consumption using a "heat factor" determined by kw.-hr. per degree-day per 1,000 cu.ft. of house volume figured on height and area

H. C. BENDER, The Washington Water Power Co., Spokane, Wash.

SERIOUS ENGINEERING consideration being given to electric house heating, particularly in the Pacific Northwest at this time, brings to light the need for some common denominator by which comparisons can be made and by which energy consumption may be estimated for different sizes of houses, various methods of application and under varying climatic conditions. The author has made a comprehensive study of available electric house heating data from many sections in an effort to find such a factor.

The nearest approach to this common denominator is what he chooses to call a "heat factor." As we have developed it, it is the kilowatt-hours consumed per degree-day of climate per 1,000 cu. ft. of house content. Degree-days based at 65 deg. are available at all local U. S. Weather Bureau offices, so that this factor in the proposed formula is readily determined. The Weather Bureau says, "to determine degree-days, subtract the mean temperature for each day from 65 deg., and add together the differences. Omit days with a mean temperature of 65 deg., or above, as heating engineers consider such days as requiring no additional heating."

A Confused Picture

Determination of the cubical content of the house has led to much confusion. One method is to measure and calculate each room and total for net volume. Closets and halls are often left out. The writer has chosen to consider overall, or outside dimensions. Gross area is simple, but determination of height is a questionable factor, and must be agreed upon. For purposes of this study the distance from the under side of the floor joist to the top side of the ceiling joist is measured wherever possible, using this as the height of the house. It has been found that if the basement were included, the heat factor became erratic, so basement has been disregarded in all cases and is considered in the type grouping.

It was soon found that similar types of houses had similar heat factors. Houses without basements, with insulated walls and weather-stripped windows, had one factor; houses without insulated walls had another; houses where the heat was generated within the room had the lowest factor, and houses where the heat was generated at a central point in the basement had still another, and the highest, factor.

In an analysis of available national information it was found the heat factor ranged from 0.8 to 0.2, which means that maximum use of electricity per cubic foot of house is four times the minimum. With use per unit varying to such an extent, it is obvious that a satisfactory heating service cannot be sold. If a house with a factor of 0.25 can be built, electric heat can be economically

Table I—Estimated Energy Usages

House	Contents in Cu-Ft.	Mild Winter 5,000 Deg.-Days		Average Winter 6,000 Deg.-Days		Cold Winter 7,000 Deg.-Days	
		Heat Factor	Kw.-Hr.	Heat Factor	Kw.-Hr.	Heat Factor	Kw.-Hr.
Small House (5 room)	5,000	0.3	7,500	0.3	9,000	0.3	10,500
		0.4	10,000	0.4	12,000	0.4	14,000
		0.5	12,500	0.5	15,000	0.5	17,500
Medium House (5 room)	8,000	0.3	12,000	0.3	14,400	0.3	16,800
		0.4	16,000	0.4	19,200	0.4	22,400
		0.5	20,000	0.5	24,000	0.5	28,000
Large House (6-7 room)	15,000	0.3	22,500	0.3	27,000	0.3	31,500
		0.4	30,000	0.4	36,000	0.4	42,200
		0.5	37,500	0.5	45,000	0.5	52,500

Note:

Heat factor 0.3 could be attained on new construction by insulating walls and ceiling and using double doors and windows, and with thermostatically controlled room units.

Heat factor 0.4 could be attained on new construction, as above, but with central heating plant in basement.

Heat factor 0.5 would result where walls are not insulated, but ceiling is insulated and heat generated in central plant.

Where actual contents of house can be secured, proceed as follows:

1. Measure outside area of floor to be heated.
2. Measure from underside of floor joist to top side of ceiling joist.
3. Multiply (1) × (2) and add second floor contents, if any.
4. Season Kw.-hr. = heat factor × deg.-days × cubic contents/1,000.
5. Season Kw.-hr. (for Spokane) = 0.3 × 6323 × cubic contents/1,000.

ed. If the factor runs much over 35, we cannot use electric heat satisfactorily.

Therefore, to keep the consumption within this range, we must build houses designed for this load. In climates as severe as Spokane, where the average is 6,303 degree-days, all parts of the house must be insulated. Walls and ceilings must be filled with insulation, double sash and doors used, and a good vapor seal obtained.

From the national study, Table II has been developed. This should permit reasonably correct estimate of consumption to be made for purposes of quotations. Monthly consumption figures can be deduced from the yearly figure by applying the percentage of monthly degree-days to the yearly degree-days for any locality.

For Spokane, these percentages are: Sept., 3 percent; Oct., 8; Nov., 13; Dec., 16; Jan., 18; Feb., 16; March, 12; April, 8; May, 4 and June, 2—total 100 percent. Heat factors in Table I have purposely been made a little high for the type of house named in order that estimates made for prospective customers will be on the safe side. The table is somewhat theoretical and lacks actual field check. It should therefore be revised as soon as possible to conform to the checks or operating data as they become available.

The author would welcome criticism and comments on this newly developed heat factor and would especially like to get more data for climates above 6,000 degree-days, and for localities where temperatures reach zero or lower.

Wichita Utilities Request Restrictions on Easements

Two Wichita, Kans., utilities, Kansas Gas & Electric Co. and Southwestern Bell Telephone Co., which operate pole lines under a joint agreement, have made a series of recommendations to the Wichita Planning Commission regarding easements in newly laid out subdivisions.

The utilities have recommended that a permanent sub-committee be set up to advise the Planning Commission on the approval of platting of subdivisions. This group, which will be composed of an engineering representative selected from each utility, would not advise approval of any platting unless proper easements were provided for all the utilities concerned.

Table II—Electric House-Heating Data

Location	Number Units	Cubic Contents (House Av.)	Insulation W-Walls C-Ceilings D-Doors & Windows	Year of Record	Season (Deg.-Days)	Installed Capacity (Kw.)	Installed Capacity (Watts per Cu.-Ft.)	Consumption Kw.-Hr. (Season)	Heat Factor (Kw.-Hr. per Deg.-Day per 1,000 Cu.-Ft.)	
Spokane, Wash.	2	12,300	None	1916-7-8	6,303 Av.	24.0	2.0	61,500	0.811	Furnace conversion. Sw. control. Opened windows to cool off. Poor construction.
LaGrange, Ill.	1	14,210	W-C-D	1928-9	6,420 (Assumed)	40.0	2.8	34,050	0.317	Water heat storage off-peak. Thermo-control.
Fort Wayne, Ind.	18	21,200		1928-9	6,420 (Assumed)	47.8	2.3	48,800	0.359	(Net area used)
Quebec, Can.	27	22,300	W-C-D	1931-2	9,935	24.6	1.1 (demand)	67,800	0.310	(Net area used)
Medford, Ore.	3	4,627	W-C	1943-4	4,654	10.5	2.27	6,256	0.291	Direct heat. Thermo-control. No basements. Insulated walls and ceilings with weather stripping on doors and windows.
T.V.A. Pickwick Landing	13	9,600	W-C	1935-6	3,831	26.7	2.74	9,760	0.264	
Portland G.E. Co.	20	7,971	W-C-D	1943	4,244	15.9	2.00	8,809	0.262	
Longview, Wash.	19	7,920	W-C-D	1942	5,620	16.5	2.08	11,800	0.264	
" "	39	8,204	W-C-D	1943	5,150	15.5	1.90	10,703	0.254	
Spokane (Part Year Only)	1	6,300	W-C-D	1944 (Part)	3,100 (Part)	3.0	1.00	5,337 (Part)	0.273	Double doors and windows
T.V.A. Knoxville, Tenn.	6		W-C	1942-3	3,600				0.319	Direct heat. No basement.
Chattanooga, Tenn.	10		None	1942-3	3,500				0.416	Thermo-control
Corinth, Miss.	6		None	1942-3	3,300				0.416	(Data from letter)
Tupelo, Miss.	11		None	1942-3	2,800				0.488	
Total	33								0.423	Weighted Av. for 33 units
Coulee Dam, Wash. Contractors' Camp	12 A-size	2,310	None	1937-8-9	5,820	4.0	1.73	6,425	0.478	Sw. control portable units
	127 B-size	4,600	None	1934-5	5,560	13.5	2.93	11,350	0.444	Sw. control portable units
	88 C-size	6,800	None	1934-5	5,560	16.5	2.43	14,100	0.373	Sw. control portable units
Total Units	227	5,330*				14.2	2.67	12,150 Wt. Av.	0.419	Weighted Av. for 227 units
Government Town	76	7,340		1943-4	6,420	15.0	2.05	20,800	0.433	Furnace conversion sw. control
Tacoma City Light	8	11,560		1938	5,059	15.0	1.30	26,630	0.453	U.S.B.R. Engineers figure
				1941-2-3	(50 Yr. Av.)				0.500	(Basement units)
Helena, Montana Gas	20	6,365	W-C-D	1943-4	8,076	21.3 (Electrical Equivalents.....)	3.33	25,000	0.487	New homes, basement gas furnaces
Boise, Idaho		10,000	W-C-D	1938-9	5,403	4.8	0.48	7,793	0.144	Coef. of performance 3½
Reverse Cycle Job	1			1943	5,738	4.8	0.48	8,550	0.148	Thermo-control panel heat

* Weighted average.

Electric Power from the Wind—II

Evidence points strongly to wind as a consistent and reliable power source if appropriately applied—Analysis of Weather Bureau records indicates that degree of variation and duration of periods of deficiency may well prove less marked than for hydro power

WIND IS AVAILABLE at velocities which permit its economical utilization at sites reasonably near load centers in nearly every section of the United States. It is free and inexhaustible. It is more universally widespread than hydro-energy. Conversion to electrical energy calls only for a relatively simple structure and mechanism: that fact was shown in the preceding article (ELECTRICAL WORLD, April 28, 1945) describing the 7,500-kw., twin-motor unit designed by Percy H. Thomas of the office of chief engineer of Federal Power Commission.

Encouragement for the detailed design of the unit was found in extensive analysis of Weather Bureau records of wind velocities and duration. At the same time much of the hesitancy in accepting wind-power as practicable in large-scale operations was discounted by the facts and potentialities uncovered in the Thomas survey recently released by the FPC.

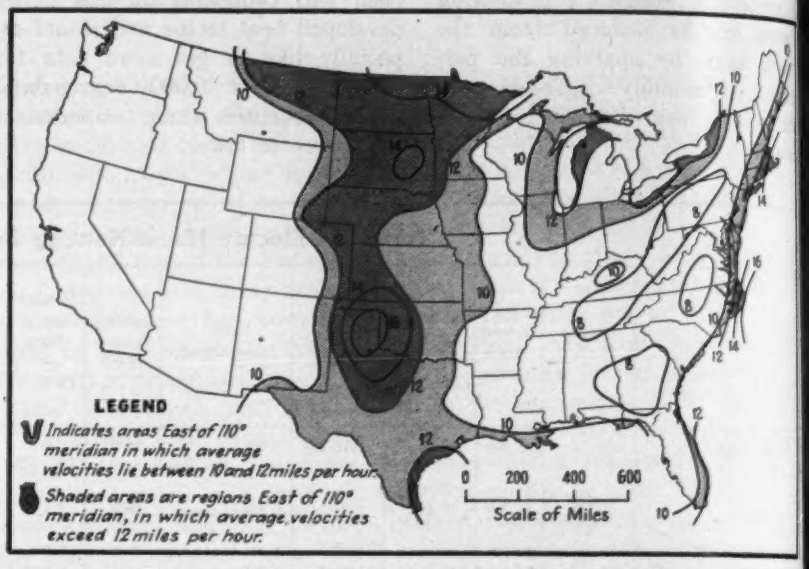

LEGEND
Indicates areas East of 110° meridian in which average velocities lie between 10 and 12 miles per hour.
Shaded areas are regions East of 110° meridian, in which average velocities exceed 12 miles per hour.
0 200 400 600
Scale of Miles

FIG. 1—Lines of equal wind velocities and selected Weather Bureau station values between 6 a.m. and 6 p.m. local standard time. Estimated for elevation of 100 ft. Regions indicated for average wind velocities from 8 to 16 mph.

Wind as a Power Source

Rapid progress in aviation technology has pointed the way to the use of the long, narrow blade—two to four per wheel—operating at much higher speed and efficiency than has prevailed for the familiar farm windmill. That forward stride removed the obstacle of the leanness of energy in the wind because the long, thin blades at high speed are capable of tapping large volumes of air to extract their energy content. Further, now that aerodynamics is a better known science, the deterrents of intermittency of wind and variability of turbine speed with wind are deemed capable of solution.

Remaining questions are essentially these: How much reliance can be placed on wind? Which are the useful winds and where are they to be found? How must the wind be handled and harnessed to derive adequate power? By no means are the answers available in full to these problems but enough has been ascertained to warrant the belief that wind power is feasible of cultivation, particularly in the areas indicated in Fig. 1.

Patterns of Wind

Daily pattern of wind shows wide variation in velocity and direction. Monthly average velocity, in very marked contrast with the daily pattern, is surprisingly constant. The annual pattern reflects comparatively small variations among the monthly averages—usually a spread of only 20 to 30 percent, (Fig. 2).

Fifty of the most representative stations recorded by the Weather Bureau over periods from 12 to 31 years have been studied. The results may be examined at the Federal Power Commission offices.

There were 13 of the 50 stations with annual average wind velocities showing a drop from the mean velocity of the observation period not exceeding 10 percent; 18 stations between 10 and 12½ percent; 13 between 12½ and 15 percent and 6 between 15 and 18 percent.

Possibility of a freak low month at any particular station must presumably be accepted but this should be considered as an emergency and handled by reserves as with hydro or other emergency.

In short, there is evidence that there is a remarkable consistency and constancy in the winds as far as monthly, annual and secular values are concerned.

Wind velocity increases with

ght above the earth's surface. How-, the information available does afford a reliable formula for the tionship. It does appear, how-, that the wind velocity 500 ft. ve the surface will have a value e 1.35 to 1.45 times the velocity hin 40 ft. of the surface. Some-re between 1,500 and 2,000 ft. velocity appears to level off.

urther, the obstruction by trees, ldings, hillocks, etc. tends to er the velocity. Manifestly any among such obstructions should be chosen after measurements de to identify their effects.

Since energy content of the wind ny point is proportional to the e of the wind velocity it is ex-nely important to take full advan-e of the velocity-height factor. ght limits will be set by the eco-nics of the tower structure.

Ratio of actual energy content of a d with varying velocity over a iod to that of another wind having fectly constant velocity of the e average value for the same iod is called the energy pattern tor or "e.p.f." for short. Thus a d blowing 20 m.p.h. for one hour calm for one hour(average 10) l have an "e.p.f." of 4. The e.p.f. found to range from 1.35 to 3.00 a considerable number of the sta-ns studied. A drop of 40 percent average monthly velocity means a op of nearly 80 percent in energy ntent; this can be met by diversity ong several such installations or resort to firming hydro as dis-sed in the preceding instalment.

Duration Curves

Due to the natural variations of d velocity from hour to hour and consequence of the "cube law," total energy derived from the d during a month depends on the rage of the cubes of the respective ocities. The duration curve as miliarly used in hydro analyses, is convenient way to simplify the de-ation of such an average. The du-tion curve shows graphically the gregate hours of duration of each ue of wind during the period stu-d. Three such curves are shown in . 3 along with the corresponding rgy-pattern factors.

Some forty such duration curves e been constructed from Weather reau data and all have shapes ch like those of Fig. 3. These com-

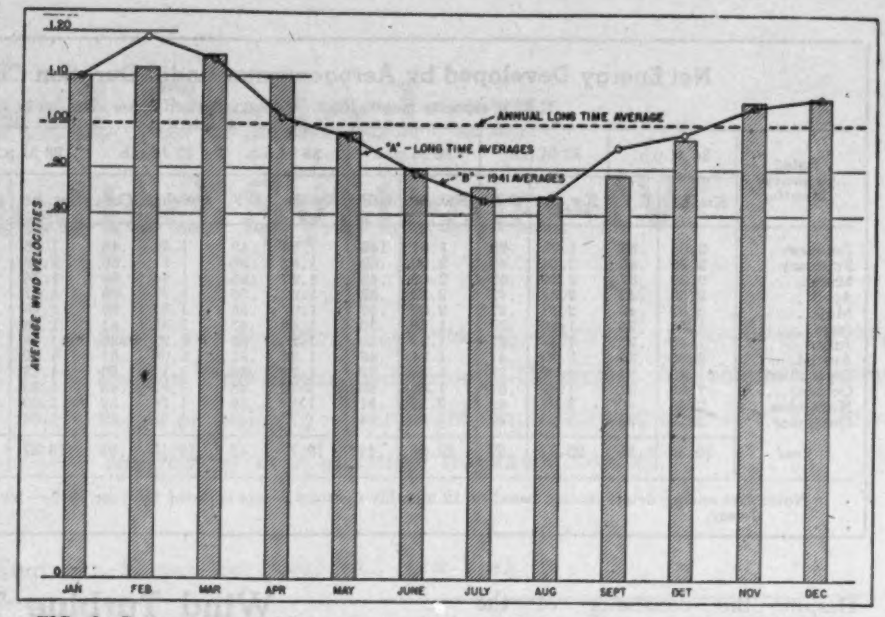


FIG. 2—Pattern of monthly average wind velocities. Bars are averages for 22 stations over many years. Lowest average velocities are in May through September. Circles on curves show averages for 29 stations for 1941

parisons again show the unappreciated consistency and practical uniformity of the patterns of the wind at different stations and for different months and years. See also the Table.

By studying 36 monthly curves for the three cities shown in Fig. 3 for a single month and applying to them certain tentative wind-turbine designs it was concluded that the choice of such rated wind-turbine capacity as would result in a capacity factor of about 50 percent would be favorable from the economic point of view. Capacity factor increases as the maximum wind velocity rating is reduced.

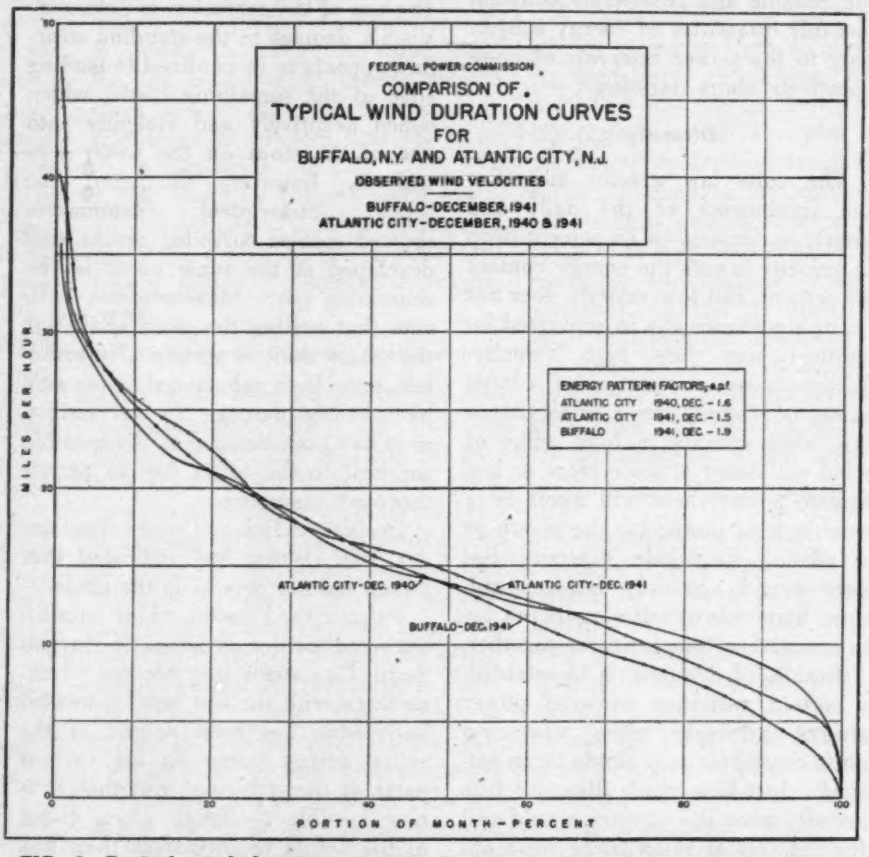


FIG. 3—Typical wind duration curves and corresponding energy pattern factors. Values adjustable to 475-ft. height by multiplying surface readings by 1.4

Net Energy Developed by Aerogenerator under Duration Curve—Typical Case

C.F. = capacity factor; E.p.f. = energy pattern factor; Kw.-hr. in 1,000,000's

Rated Capacity, Months	34 M.p.h.		32 M.p.h.		30 M.p.h.		28 M.p.h.		27 M.p.h.		26 M.p.h.		24 M.p.h.		No Limit		Max. Wind, M.p.h.
	Kw.-hr.	C.F.	Kw.-hr.	C.F.	Kw.-hr.	C.F.	Kw.-hr.	C.F.	Kw.-hr.	C.F.	Kw.-hr.	C.F.	Kw.-hr.	C.F.	Kw.-hr.	E.p.f.	
January.....	2.05	.33	1.93	.38	1.81	143	1.69	.48	1.62	.48	1.56	.56	1.42	.64	2.83	1.68	43
February....	2.60	.45	2.34	.48	2.09	.52	1.82	.56	1.71	.56	1.60	.61	1.35	.66	4.45	1.87	47
March.....	2.32	.37	2.20	.43	2.08	.49	1.93	.55	1.84	.59	1.76	.63	1.48	.69	2.61	1.44	47
April.....	2.53	.42	2.32	.47	2.12	.52	1.92	.56	1.77	.59	1.67	.62	1.43	.68	2.96	1.45	46
May.....	2.62	.42	2.41	.47	2.05	.52	1.97	.56	1.85	.59	1.73	.62	1.50	.68	3.88	1.67	42
June.....	1.54	.25	1.49	.30	1.45	.36	1.40	.41	1.35	.41	1.28	.48	1.16	.55	1.55	1.36	33
July.....	1.40	.23	1.37	.27	1.32	.31	1.25	.36	1.22	.36	1.18	.42	1.08	.50	1.46	1.40	41
August.....	2.25	.36	2.08	.41	1.94	.46	1.28	.51	1.68	.51	1.60	.58	1.41	.65	2.60	1.57	47
September...	1.46	.24	1.38	.28	1.30	.32	1.22	.36	1.17	.36	1.13	.42	1.01	.49	1.96	1.74	38
October.....	1.96	.31	1.87	.37	1.80	.43	1.70	.48	1.62	.48	1.53	.55	1.35	.62	2.32	1.48	34
November...	2.41	.40	2.27	.45	2.12	.51	1.86	.56	1.76	.59	1.69	.63	1.36	.70	1.96	1.39	33
December....	2.17	.35	2.03	.40	1.90	.44	1.73	.49	1.53	.49	1.54	.55	1.34	.61	2.61	1.49	36
Year.....	25.30	.35	23.71	.39	22.06	.44	19.77	.48	19.13	.52	18.37	.56	15.88	.62	31.20	1.60	47

Note: Net energy determination based on 12 monthly duration curves covering the year 1940 — for Weather Bureau station at Atlantic City, New Jersey.

Despite the constancy of the monthly averages and the consistency of the duration curves, there remains the uncertain behavior from hour to hour. Alone, unsupported wind-power generation cannot, in view of this recognized fluctuation, be relied upon for firm power. Unless this objection can be overridden, wind power is reduced to the status of secondary power. As secondary power, however, it would stand high, offering reliable and reasonably constant monthly quantities of energy subject only to low-power intervals of comparatively short duration.

Diversity

The cube law greatly magnifies the significance of the daily and hourly variations—a 15 percent drop in velocity lowers the energy content 39 percent. But low velocity does not occur simultaneously in separated localities; nor does high velocity. Whenever any one station of a large group of stations has momentarily a low wind velocity, a high value of wind will occur at some more or less remote point; there will never be a total lack of power for the group as a whole. Favorable diversity has been found not only between stations hundreds of miles apart but between stations much nearer together.

Results of diversity is to establish a certain minimum of wind power always available when numerous units contribute to a single large network. Just how much diversity lists broadly over the country would call for analysis of many more wind observations than the few thousands so far analyzed.

Wind Turbine To Be Rebuilt

Inspection following the recent failure of one of the blades of the test unit of the Smith-Putnam 1,000-kw. wind turbine on Grandpa's Knob, at Hubbardton, Vt., on March 26 last (see ELECTRICAL WORLD) April 7, 1945, page 8), showed that the blade spar had failed along multiple and corroded cracks at the outboard edge of the bolted shank spar connection. The age of the corrosion is unknown. Visible damage to the standing structure appears to be confined to leading edge of the remaining blade, which coned negatively and violently into one of the stops on the tower legs without, however, damaging the tower. Subsequent examination showed similar corroded cracks well developed at the same point in the remaining spar. Measurements indicate that neither the main shaft nor the pintle shaft is sprung. Nevertheless, these high unbalanced forces may have caused damage not yet visible, so it has been decided to disassemble the unit to the tower cap to permit thorough inspection.

Design studies and early tests under Den Hartog had indicated that flutter was not present in the blade.

Palmer C. Putnam, chief consultant wind turbine division, S. Morgan Smith Co., states that because of experience with the test unit, increased knowledge has been gained of the actual forces acting on the various parts of the structure, and that it is now feasible to design much closer to the actual requirements than was possible in designing the present unit. "We believe," says Mr. Putnam, "that we can design and build wind turbines which are entirely practical for continuous operation and within the limits of safety obtained with other forms of prime movers. Advantage will be taken of the disassembly to reflect in the rebuilding the various lessons learned during the three years of the test program, and more particularly, the lessons learned from studies of this accident. One of the factors contributing to the belief of all concerned that the project has a vigorous post-war future is the receipt of some 200 serious inquiries from all quarters of the world during the past three years. The rate of receipt has shown an increase from year to year.

Rebuilding is under way.

Summary of Operation

The unit first went on test October 19, 1941, and remained on test until February 20, 1943, having been on the line 695 hr. and 192 hr. off the line, generating 298,240 kw.-hr. Then various improvements and repairs were made and the unit was put back on the line March 3, 1945, and for the first time began routine operations as a generating station without interruptions for testing. Between March 3 and 26, 1945, the unit operated 143 hr. and generated 61,780 kw.-hr. during an unusually windless three weeks for March at the Green Mountain site of the wind turbine. The total output of the unit to the time of the accident was 360,020 kw.-hr. and an operation of 838 hr. on the line and 192 hr. off the line, with an average output level of 431 kw.

Speed, Load Control on Interconnected Systems—IV*

Slope of governor characteristic—Active vs. inactive governors Tie-line load control advocated—Correction for sluggish governors Points on testing governors—Manual resetting after load changes less satisfactory than electrical frequency control

E. E. GEORGE, Electrical Engineer, Ebasco Services, Inc., New York

GOVERNED UNITS will not operate in parallel unless the governor provides a droop or slope in speed as the governor opens the valves. Droop is frequently called "regulation" or "slope". The latter term is used in this discussion in preference to the other. It is more descriptive, as it indicates the falling off in governed frequency as the power output is increased. (See Fig. 5 of the preceding installment). For many years the amount of slope for best operation has been a controversial subject. Recently every large group of interconnected systems has settled upon some value between 3 and 6 percent. The new trial steam-turbine governor specifications of the AIEE-ASME call for an overall slope between 3 and 4 percent unless otherwise specified.

The advantages of small slope are:

(a) increased sensitivity to frequency change

(b) Inereased response to frequency change

(c) No tendency to trip overspeed devices.

The advantages of large slope are:

(a) Increased stability of the governor itself

(b) Better parallel operation between plants

(c) Increased stability between systems

(d) Less load change on plants.

The slope of steam governors is not easily adjustable (except on a few special designs). On flyball type governors the flyball weights or the effective spring turns and spring tension must be changed. On the impeller type governor, the leverage or the secondary pressure compensation must be changed. The steam turbine manufacturers can provide any slope between 2 and 6 percent, but some of them do not encourage the customer to test or change the original setting.

Many hydro governors of recent design have control dials, scaled 0 to 5 percent, to change the slope while the unit is operating. Sometimes the slope is set small when frequency regulation is needed, and set large at all other times.

The trend is toward lower overall regulation, to take advantage of the setter design of newer governors (more uniform incremental regulation).

Active versus Inactive Governors

Since the inherent slope of a system without governors (or with the governors blocked) is 15 to 40 percent, governors will provide a great improvement in speed control, even if their slope is high, provided that *all* governors are in service and that all operate *properly*. If only 25 percent of the system capacity is operating with governor control and 5 percent slope, the effective slope is really 20 percent, or four times as high as it need be. Recent tests (for 0.1 cycle changes) on one large interconnected area show 18 percent slope. The average would be still larger than 18 percent if allowance had been made for "dead band". Since all of the units in the area presumably have governors and their slopes are from 2 to 8 percent, it seems that many of them are inactive on 0.1 cycle speed changes, due to blocking, use of load limits, use of base load setters, wide open valve operation, inadequate design, or deferred maintenance.

Even if the system is part of an interconnected area, and the frequency regulating plant is in a different system, there is still the need for frequency response from all governors. As used today in all large interconnected groups, the frequency regulating plant is merely a vernier control, accurately controlling frequency for small load changes, but requiring help on changes outside a very narrow range. The frequency regulating plant operates in parallel with every governor in the group, with the contribution of the frequency regulating plant limited by its capability on large changes, and with no contribution from the other governors on small changes due to their dead bands.

Frequency Control

On a large area with units of different ages, very little governor response would be expected for frequency changes of 0.01 to 0.04 cycle, until electrical control is added to hold frequency or tie-line loading. Slow frequency drifts of 0.1 cycle or more should get a response from all governors on major units. Without the assistance of substantially all the governors in the area, operation will not be nearly as good as it could be. With isolated operation and only partial governor response, frequency control

* This series began in ELECTRICAL WORLD, March 17, 1945, page 84.

will be poor during normal operation and will be lost during emergencies. With interconnected operation, and only partial governor response, the frequency regulating plants will have less assistance, the tie-line loading will vary more with a given frequency change, and the frequency changes will be greater.

Under present conditions on typical large interconnected areas, the typical maximum speed variation is 0.05 to 0.15 cycles, occurring several times daily under normal conditions. These figures would probably be reduced by 50 percent if automatic tie-line control were in use on every major inter-system tie.

Frequency regulation could be still further improved, especially during trouble, if every governor were left in service (excepting governors obviously defective or of very inadequate design).

The wide frequency band common to most systems until about 1930 to 1935 was probably responsible for the use by some systems of governor load limiting devices on base load units, since turbine loading might otherwise vary plus and minus 10 percent, and the boiler and furnace controls might have to be changed every minute or two. Every change in the rate of fuel consumption lowered the boiler economy temporarily. To prevent the governors from following the frequency load-limiting devices were used with the basic purpose of improving boiler room economies.

Operating Economics

The fact should not be overlooked that system operating conditions are materially different today. The frequency band is now so narrow that the most sensitive mechanical governor will hold flat load for many minutes at a time. At times when the frequency changes 0.1 cycle, a governor of 5 percent slope will change load 3 percent or less. The effect of occasional 3 percent output changes on boiler room economy is difficult to analyze except by local test, but there is certainly some range of load changes within which the value of governors to the system more than offsets the loss in boiler and furnace efficiency. If the governor is set for 100 percent of rated load at 60 cycles, the turbine will average about the same kw.-hr. output as if the valves were blocked at 100 percent load, and the loss in turbine economy for loads between 97 percent and 103 percent will be too small to measure. The average load is substantially 100 percent because the frequency averages 60 cycles, with a cumulative error not over one part in 29,000 per day (assuming 3 seconds maximum time error).

Improved frequency regulation due to active governors permits a slower and more economical rate of correction.

If the base-loading of plants or the use of load limits is carried to the extreme of reducing regulating capacity below that needed for control, it defeats its own purpose, because swings will get worse and block changes will have to be made on base-load plants to help the regulating plant. If sufficient regulating plant capacity is not provided to prevent large deviations in frequency, then even more capacity at base load plants will have to be used for the correction of such deviations.

Desirability of keeping all good governors in active service was clearly shown by Fig. 3 of the preceding installment.

Uniform versus Non-Uniform Slope Settings

Most large interconnected groups of systems have urged that all governors be set at (or close to) some uniform droop or slope, excepting topping units and other special situations. The slopes adopted have been between 3 and 6 percent.

Use of a uniform slope for substantially all units is contrary to previous practice in most systems and has been questioned from several angles.

The arguments for uniform slope may be summarized as follows:

(1) Changing of slope on steam governors has not caused any difficulties where tried.

(2) Changing of slope is standard practice on hydro governors.

(3) Elimination of small slopes improves system stability.

(4) Elimination of large slopes improves frequency regulation,—both normal and emergency.

(5) Incremental slope is generally much different from average slope. Unless checked throughout by testing, a small average slope is dangerous.

(6) Uniform slope promotes flexibility of operation. Any unit can be used for regulation at any time.

(7) Uniform slope permits uniform results from bias frequency load control.

In contrast with the foregoing advantages from an electrical standpoint of uniform governor slope on large interconnected systems, several disadvantages from a mechanical standpoint have been suggested. These are as follows:

(1) Difficulty of changing slope.

(2) Suitable governor test equipment is not easily available.

(3) Limited cooperation from certain manufacturers in changing slope of governors.

(4) Uniform slope results in poorer frequency control on regulating plants unless electrical control is added.

(5) Uniform slope results in higher generating cost at base load plants.

(6) Possibility of trouble in disturbing a governor in satisfactory operating condition.

Base and Regulating Units

When non-uniform slope is the prevailing policy, the base load units are generally set with large slope, and a regulating unit is set with small slope "to take the swings". The regulating unit is generally selected on account of its relatively poor fuel economy.

With this plan of operation the regulating unit is given work which could have been divided between several units. Unless it is a fairly large percent of system capacity, it cannot handle large load swings, regardless of its slope. It cannot match the speed of response of (for example) three similar size units unless its slope is one third of their slope. Such a wide range in slope is impractical, because of the variation of incremental from average slope.

Even with every governor set to an overall slope of 5 percent there are likely to be some governors having points of 2 percent incremental slope and some having points of 15 percent incremental slope. Small incremental slope is particularly serious as it reduces the stability of the whole system. If negative or very small, the machine will be unstable, even if isolated on a water-rheostat load. The objection to using an overall slope of less than 3 percent is that certain machines are almost sure to become unstable under some conditions of

loading and frequency change. The objection to using a slope of over 6 percent is that system regulation is poorer. The gain in stability is small, and the gain in economy due to steadier load is negligible. Although some manufacturers claim a nearly linear incremental regulation for modern governors, the proposed AIEE-ASME governor standards of May 5, 1944, permit the regulation to vary from 50 percent to 200 percent of the overall value. Many difficulties with governor performance are due to abnormal incremental regulation at some point of load.

Uncoordinated Action

Governors which are inactive, due to load limits, high slope, large dead band, or tight dashpots will operate if the frequency change is large enough and long enough. By that time, the sensitive governor will probably have corrected most of the load unbalance, and will now have to undo the work of the sluggish governors.

Unless the rate and time of response of all governors is coordinated, there will probably be a lot of unnecessary trading of load between units, plants, and systems, due to one governor having to undo the work of another one.

Many of the advantages of small slope of governors can be obtained and increased by electrical control devices operating on governors with large slope.

A further refinement has been suggested recently, proportioning the incremental slope and time delay of each governor to the inertia constant of its generator and turbine. This would improve stability on fast frequency changes. If the incremental slope were fairly constant throughout the operating range, much improvement might be gained by observing this relation. Optimum stability requires that the product of governor droop, governor time delay and machine inertia constant be the same for every turbo-generator unit.

The balance between advantages and disadvantages of uniform slope as regards general policy and exceptions is a local problem worthy of considerable study, with due regard for present and probable future operating conditions.

Testing of Governors

From an analysis of operating difficulties, several companies have come to look upon governors as necessarily adjustable, capable of being tested locally, and worthy of a high standard of maintenance. These companies have developed methods of testing and adjusting steam governors. The testing of slopes is usually a determination of the full-load and no-load points, referred to 60 cycles at full-load. This slope or regulation applies to large changes occurring slowly. The transient or incremental regulation on small changes may be much different, depending on sensitivity, time delay, and shape of droop curve between the no-load and full-load points.

The only means of determining the dead-band, time delay, and transient characteristics is to use a special multi-element high speed graphic recorder, instantly responsive to small changes in frequency, time, and kilowatts. The same device will give the incremental regulation for typical operating conditions. A slow speed oscillograph will provide some valuable information.

If it is desired to analyze the performance of the various elements of the governor, the graphic recorder must also record the rate of motion of the governor arm, pilot valve, and main valves.

Indicator cards of the main and pilot oil cylinders can be taken to check friction, lap, dashpot adjustment, and by-pass adjustment.

Manual Control

Although governors make it possible to hold frequency within 5 percent for 100 percent load change (5 percent slope), still better average frequency can be held if the governor is reset to normal frequency after every sustained load change. This is done by a movable fulcrum on the governor arm. This fulcrum is positioned by a motor-driven device, operated by raise and lower push buttons in front of the operator. The whole assembly for resetting the governor speed to 60 cycles for any load is called the synchronizing motor control, because it was first used to control speed during synchronizing. By continually watching an accurate frequency meter and resetting the governor after every major change, an operator can hold good average frequency. Of course, this procedure cannot approach the accuracy or economy of electrical frequency control.

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Voltage Ratings for Industrial Systems

Items for consideration in establishing industrial system and apparatus voltage ratings are presented. They are some of the high points of the discussion at the Midwinter A.I.E.E. meeting and are in addition to other viewpoints outlined in ELECTRICAL WORLD, April 14, 1945, page 108.

Some users have a desire to keep increasing the line voltage. The thought is that higher voltages are helpful for higher torque on motors. In such cases motors should be for standard voltages and high torque rotors applied.

Another user recommended that the standard nominal voltage be based on 120 and that higher voltages be in multiples. Transformers with 2½ percent taps above and below standard voltages would help where voltage variation occurs.

It should be understood that 120 and 2,300 volts cannot be reconciled if even multiples, such as in ratios of 10:1 and 20:1, are used for transformers. Here 120 and 2,400 volts would be considered nominal values.

An electrical equipment manufacturer pointed out that a range of 107-127 volts, for example, for a device is not intended as the voltage spread for the utility to supply but are limits to which the manufacturer must design. To avoid confusion it was thought that consideration be given to omitting the spread.

To obtain the proper return for the investment, the system must be designed for the correct operation of the equipment. For proper voltage maintenance, a voltage regulator could be used. By this device, the user could specify that the equipment and system volt spread be narrow.

Similar standardization of d.c. equipment and d.c. system voltages should be considered, according to a mining company engineer. Motors are rated at 220, 230 and 250 volts and conversion equipments are rated at 250, 275 and 300 volts.

Editorials

S. B. WILLIAMS, *Editor*

Manufacturers Urged to Make Pre-Termination Agreements Now

THE OFFICE OF CONTRACT SETTLEMENT reports that only a very small percentage of war contractors have made pre-termination agreements with their customers These agreements should be made immediately, otherwise there may be later delays that can prove very costly to a manufacturer.

The order governing work continuation on terminated contracts states that no agreement is necessary if work stops immediately on notification, but if it continues so certain work can be completed, either to protect customer's interest or for the manufacturer's account, a definite agreement must be made with the customer in advance of termination.

Where, for reasons of safety, or to avoid damage to production equipment or spoilage of work-in-process, it is necessary to carry out work to a practical stop-work stage, this stopping point must be agreed on beforehand. Likewise, when a manufacturer wants to retain work-in-process in order to continue production on his own account the retention value should be agreed on before termination.

A number of contracts have been terminated within the past two weeks and others can be expected. For that reason it is advisable to get the pre-termination agreements signed just as soon as possible. While this procedure has been worked out to protect the government against unnecessary loss, it at the same time protects the manufacturer and makes the termination process and account liquidation easier in the long run.

The larger manufacturers have their own termination committees to protect them. It is the smaller war contractor who has failed to make these pre-termination agreements and, unfortunately, it is he who will probably need them the most in order to release working capital promptly and permit production to go along without long delay.

There are twenty-one termination coordination committees serving the country. Manufacturers unable to work out such agreements should contact their area committee.

REA's Tenth Anniversary

THIS WEEK REA celebrates its tenth anniversary. Since the Rural Electrification Administration was established on May 11, 1935, over half a billion dollars have been allocated by it for lines in 46 states and two territories. Of this amount 415 millions have actually been advanced to borrowers of which 833 are cooperatives, 54 are public bodies and 19 are private utilities.

At the end of its first ten years REA-financed systems had over 400,000 miles of line in operation which were serving in excess of 1¼ million consumers. The energy consumed has reached an annual figure in excess of two billion kilowatt hours.

Starting out as a work relief project, rural electrification now has become one of the major activities of the national government. This is evidenced by REA's three-year post-war program of $579,000,000, now awaiting Congressional approval, which is approximately 50 percent more than was spent in its first ten years.

When this program plus that of the power companies is carried out, whether it be possible in three years or some longer time, electric service should be available to nearly every farm that might expect to secure service on a pay-out basis. To really pay out, however, even on present extended amortization and low interest rates, the farms will have to consume considerably more electrical energy. The big program, therefore, that is ahead and for which there is no end, will be the stimulation of farm use. In that program there should be no competition but all should work together. It will be interesting to see if as much progress in usage is made in the next ten years as there has been in rural extensions in the past decade.

Electric Water Heaters and Automatic Washers

WHAT will the sale of automatic home laundry equipment do to the sale of electric water heaters? Will it help, or will it harm? Are the conditions under which electricity is supplied for water heating such that the automatic washing machine can be used without raising the cost of hot water higher than the customer is willing to pay? Is the charging period long enough or the lower heating element large enough that there will be adequate hot water for the washer? Or will the high-rate top element have to come in in order to make up a significant deficiency in hot water supply?

Possibly more than we think of the so-called "favorable" rates for electric water heating are not so favorable that customers will be entirely happy with their bills if they buy automatic washing machines. Off-peak charging periods are too short and ratings of lower heating elements are too small in these cases for it to be said confidently that customer complaints of high bills will not follow purchase of an automatic washer. And that won't help the sale of electric water heaters.

A manufacturer of these appliances expresses this fear

a letter which accompanied his contribution to a survey post-war appliance sales which will be reported in the ext number of ELECTRICAL WORLD. He urges attention the condition and says that if measures are not taken cure it, he fears "that a considerable number of sales ill be lost to other and faster methods of water heating."

Something New in Annual Reports

RECENTLY one of the large insurance companies tried something new in its annual report. Instead of having the president present the year's achievements it asked one of its policy holders make a report to the policy holders. As we read it, we wondered if the idea might not be feasible for the utilities. Suppose a customer were to write a report for a company. What would he find of interest to talk about? Maybe he would play up some things that the company thought of little moment while some of the big programs that the company officials thought were pretty good might leave him cold. At any event such a report should be as illuminating to the management of the company as to its public.

Newspaper Editorials

AN EDITORIAL which recently appeared in one of the country's leading metropolitan dailies, endorsing the Tennessee Valley Authority has caused a considerable stir within utility ranks because this particular newspaper which is widely read throughout the country has always been conservative and does not crusade. It has no valley authority projected for its area, so it can be presumed to have reached its position on TVA objectively.

If it is true that this newspaper came to its decision without any prejudice or pressure then the electric utility industry should "view with alarm." The cause for alarm is not so much the fact that paper should endorse a valley project as it is that TVA has done such a superb publicity job compared to that of private power. This is not the only instance of a reputable newspaper endorsing TVA; there have been others in the last year or two. Why? Because the TVA people have put romance into their operation. They have talked about a region and about people.

If every newspaper had available as much information about the utility industry as it has about TVA, and if it were made interesting, then perhaps the industry would have less cause for complaint. Most members of the industry who have seen any of the TVA promotional material have to admit its effectiveness, even when disagreeing with some of the data and implications. The industry itself, however, has seemingly preferred to hide its light under a bushel—at least it has made very little effort to show what it has contributed to the economy of the country or region by region.

Lighting Manufacturers Want Shipping Cartons Returned

IT WASN'T SO LONG AGO that the only way one could get a tube of tooth paste was to turn in an empty tube. It may not come to that in shipping cartons but a group of lighting equipment manufacturers recently told a group of wholesalers that if some way could be found to return cartons in a good condition it would be possible to ship out more orders. This isn't something new. It's a condition that has been with us for some time only it can be worse with a sudden rise in orders for civilian use or for stocking.

Cartons that have been shipped long distances do not always arrive in good condition but those that are not damaged in shipment can be returned if stock clerks are cautioned to open and handle them carefully. This is a condition that can be expected to last as long as there is a paper shortage and that may continue for many months.

Appliance Service by Contract

WITH THE ANTICIPATED large post-war increase in the numbers of electrical servants in American homes the problem of keeping these servants at work by curing their occasional ills will also become larger. Although in terms of revenue and of customer contentment it is greatly to the utility's interest that they be kept in continuing good health, that interest is not strong enough to carry the entire burden of their care.

The inability of the utility to discharge the whole responsibility for servicing appliances was becoming increasingly apparent in the years before the war. Many power companies were squirming and unhappy under the load and were trying to shift to other shoulders that part of it that really belongs on them. After the war the utilities will be even less willing to assume any more than their share of responsibility for keeping appliances in operating condition.

Here is an opportunity for display of enterprise by "small business," in whose fortunes government now loudly professes so much concern. The way is indicated by successful operations in contract maintenance of electric signs and other outdoor lighting installations which is now in some instances being expanded to cover fluorescent lighting also.

In a given community one or more electrical contractors, or perhaps concerns set up for the specific purpose, might undertake the appliance service job. Department and hardware stores and other retail outlets would undoubtedly be glad to contract for performance of guarantee obligations and be left free of all but their principal interest of merchandising appliances. And the local utility would be happy to have an agency to which appliance repair calls and complaints could be referred in complete confidence that work would be done competently and customers be treated fairly.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Ickes' Master Plan for Regional Developments

HAROLD L. ICKES' master plan for development of the resources of the United States is contained in the draft of a bill which is sufficiently far-reaching to make much New Deal legislation look pale in comparison.

Not yet introduced as legislation, although much of it has been copied in various bills now pending, Ickes' proposal, which has been kicking around Washington for some time, was laid before the Senate Commerce subcommittee which reported adversely this week on the Murray bill to establish a Missouri Valley Authority.

Regional Developments

Congress has before it, Ickes told the subcommittee, . . . "a major step in the basic reorganization of the government of the United States . . . The federal government . . . has been organized . . . on a functional . . . (rather than) . . . a geographical basis. The single major exception is TVA. The success of TVA has convinced me that the theory of governmental organization by regions rather than by functions is a sound one for many aspects of natural resource administration, if wisely used."

Ickes' proposal creates a basic code for regional authorities, and provides that the "major rivers" of the land may be brought under authorities merely by adding successive titles to the bill, naming and defining the basins it is desired to develop. Ickes includes titles establishing MVA and a Columbia Valley Authority.

Ickes starts by assuring that regional development authorities shall be controlled in Washington, made to fit their plans into an overall national policy, by constituting the Secretary of Interior as chairman of a River Basin Development Board whose other members would be the Secretary of Agriculture, the Chief of Army Engineers, the chairman of TVA, and the administrator of each other river authority in existence. The board, using available federal agencies, would develop the programs, and the authorities would have to tailor their works to the overall concept of the board.

An authority established under the Ickes program would not merely be in the power, water and fertilizer business. To assure true regional development, it would conduct "economic, scientific and technologic" studies, operate laboratories, research facilities and pilot plants aimed at developing "new and improved techniques and methods for the discovery, extraction, production and use of the resources and products of the region . . ." It would have the power "to acquire, without reimbursement, any properties defined as surplus under the Surplus Property Act of 1944, and to maintain, repair, alter, use and operate such properties and any other properties which may come into its custody until other proper disposition be made thereof." An authority, thus, could take over not only the war-born power plants which are to be disposed of, but federally-owned war plants as well.

Sales Policy

Powerwise, an authority could sell energy and interconnect with public and private systems; would be required to build such facilities as it thought necessary to prevent monopolization of its output; give the usual preferences in selling power; and withhold its energy from private purchasers pending organization of public distributing bodies. It could contract for sale of energy "at wholesale . . . whether for resale or direct consumption." It could sell directly "to persons located near its lines . . . to whom it finds electric energy would not otherwise be reasonably available."

An authority would help potential customers build, acquire and operate electrical facilities and help non-private purchasers organize distributing agencies having a preferential status. It would "acquire and operate electric utility systems . . . the acquisition of which will improve the operation of the authority's electric facilities . . . or facilitate the development of appropriate marketing outlets . . ."

Distribution facilities picked up in the acquisition of utility systems would be sold to public bodies and co-ops, but could be operated by an authority pending selection of a suitable purchaser. Acquisitions would be financed by revenue bonds secured solely by authority revenues and issueable in manner and amount determined by the authority. Bookkeeping would be under FPC's uniform system of accounts "with such modifications as may be deemed . . . necessary or desirable . . ."

Tax Provisions

Payments in lieu of taxes on real and tangible personal property acquired in connection with power operations would be made yearly at then current rates on a valuation equal to the average of the assessed values for the three years preceding acquisition of the property by the authority.

Payments in lieu of business, franchise, excise and similar state and local taxes on utility systems acquired by the authority would be made in amounts equal to those which would have been levied had the system been under private ownership.

Payments on real and tangible personal property other than that acquired for power purposes could be made by agreement with the taxing district on the basis of services rendered by the taxing unit, the extent of reductions in tax revenues resulting from the acquisitions, the benefits derived by the unit from the authority and such other factors as the authority might stipulate.

Ickes' tax proposals are noteworthy. One wonders how much they result either from the apprehension shown by state and local taxing bodies over the persistent removal from the tax rolls of such excellent sources of revenue as electric utilities have shown themselves to be.

NEWS OF THE WEEK

OWU Amends U-1, Revokes All Supplementary Orders

Ceiling of $25,000 Placed on Minor Capital Additions—Restrictions Requiring That Construction Be Held Down to a Quality Sufficient to Serve at Minimum Wartime Service Standards Removed

Order U-1 was amended by the Office of War Utilities this week to allow a ceiling of $25,000 on minor capital additions and to remove restrictions requiring that construction be held down to a quality sufficient to serve at minimum wartime service standards.

Preference ratings and the prohibition against subdividing jobs to bring them under the $25,000 ceiling were retained, as were restrictions on inventory and deliveries.

All orders supplementary to U-1 were revoked.

In raising the minor plant additions ceiling to $25,000, OWU split the ratings which may be applied. Any minor plant addition which is not an extension to consumer premises and whose net material cost is $10,000 or less gets an automatic AA-1 rating for the full value of the project. Any minor plant addition whose net material cost is from $10,001 to $25,000 gets an automatic AA-3 rating for the full value of the project. Any minor plant addition which is an extension to consumer premises gets an automatic AA-3 rating regardless of the value of the project. Any continuous extension which a utility chooses to build will be allowable provided material cost does not exceed $25,000.

Paragraph (i) (4) of U-1 was so modified as to remove the ban on extensions to consumer premises not allowed by a supplementary order or specifically approved.

The automatic AA-1 and U-9 rating and allotment symbol continue to apply to materials required for maintenance, repair and operating supplies.

In junking the restriction that jobs be held down to the work necessary to provide service at minimum wartime service standards, OWU emphasized that utilities may proceed to care for deferred maintenance and plant rehabilitation. The new restriction stipulates that jobs must be done so as to "render service in accordance with economical and sound operating standards." While the new phrase forbids "gold-plating," it was construed by OWU officials as allowing utilities to do about what a conservative, well-engineering job would require in normal times. It was learned that this new standard will apply to whatever major capital additions are granted hereafter on Form WPB-2774.

Existing restrictions on inventory and deliveries were retained in the belief that they would allow companies to hold and purchase ample supplies and yet prevent inordinate stockpiling. Their presence will require careful purchasing when additional construction is contemplated under the $25,000 minor plant addition ceiling, for under Paragraph g of U-1, utilities are prohibited from ordering and specifying a delivery date for material which would occur more than 90 days in advance of the anticipated date of use. Materials which cannot be used within 90 days after delivery should not be ordered, OWU officials emphasized.

All restrictions on sales from inventory were lifted, allowing utilities henceforth to sell anything in inventory to any purchaser. Materials so sold, however, may not be replaced by the use of ratings automatically assigned in the order unless:

1. The sale was to another utility.
2. The sale was to a customer for the repair of damage to his facilities.

The provision requiring that a utility sell from inventory to another producer, under stipulations, was revoked.

Retention of the restrictions on inventories and deliveries was expected to put considerable premium on construction manpower in areas where there is competition for presently unserved territory. OWU officials urged that every effort be made to bring service as rapidly as possible to persons certified for service but as yet unserved, those who have been promised service and those who have wired their homes or made other preparations for service.

The prohibition against serving customers who are being or who have been served was retained.

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Soft Coal Production Drops 18,000,000 Tons

Bituminous coal production in the first four months of the year was almost 18,000,000 tons below that of the comparable period in 1944, Solid Fuels Administrator Harold L. Ickes announced.

The national bituminous stockpile on April 1 was 45,494,000 tons, a drop of 279,000 tons from the March 1 level. Unusually warm weather in March slowed withdrawals from stockpiles, and the lowering of consumption requirements with the end of the domestic heating season increased the average number of days of supply to 27 on April 1, even though the entire stockpile showed a slight drop.

Electric utility stocks on April 1 totaled 12,519,000 tons, a decrease of 400,000 tons from the March 1 level, but an increase of 5 days supply. Electric utilities consumed 6,186,000 tons in March or 24,000 tons less than they consumed in February. Daily average consumption by the industry in March was 199,548 tons or 22,000 tons lower than the daily average in February.

Average number of days supply by regions was as follows: New England, 87 days, up 16 days; Middle Atlantic, 55 days, up 8; Ohio, 41 days, down 1; Michigan, 47 days, down 3; Illinois-Indiana, 60 days, no change; Lower Missouri Valley, 67 days, up 10; Lake Dock

territory, 79 days, no change; Southeast, 94 days, up 11; Southwest, Mountain and Pacific, 106 days, up 9; total all regions, 63 days, up 5.

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2 Floating Power Plants May Be Sent Elsewhere

Possibility that two of the five floating power plants available for military duty may be redirected to new points of service arose with the end of the European War this week.

Two of the four Defense Plant Corporation floaters, each of which is capable of operating at 30,000 kw. capacity, are presently serving in the European theater and will not be moved in the near future, it was learned.

A third DPC floater, which had been scheduled for the European sector, may be redirected to the Pacific. The fourth DPC floater, which has been serving the Jacksonville, Fla., municipal system since last month, might be commandeered for use by the Navy at Pearl Harbor, although this possibility was not regarded as likely this week. It was understood that the Navy would be required to send a 10,000-kw. power train, now laid up for stand-by use at the Philadelphia Navy Yard, to Jacksonville if the 30,000-kw. floater is taken by the Navy. It was understood that the Jacksonville system would need assistance only until mid-June, when a 30,000-kw-. machine, now down for maintenance for the first time in four years, is to be back on the line.

No decision had been reached early this week as to whether the "Jacono," requisitioned by the War Shipping Administration from the New England Public Service Co., would be sent overseas or not. The "Jacona" has a 20,000-kw. plant.

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Clark County P.U.D. Suit Moved to Federal Court

Condemnation proceedings brought by the Clark County, Wash., Public Utility District against the Pacific Power & Light Co. and the Northwestern Electric Co. have been transferred from state court to federal court and will be heard in the United States District Court at Tacoma.

Petition for the removal was made on grounds the Pacific company is not a Washington corporation. In the suit the P.U.D. seeks to condemn all property of the two companies in Clark County, which includes Vancouver, where a plant of the Aluminum Co. of America and a Kaiser shipyard are located.

Brownout Abandoned with V-E Day Arrival

Restrictions Saved 500,000 Tons of Coal—Cooperation Made Enforcement Problems Easy

The Brownout was lifted this week after three months and eight days in which it saved 500,000 tons of coal at a time when coal savings were needed in the worst way.

Official revocation of Order U-9, instituted last February 1, took place as President Truman told the nation of the unconditional German surrender.

Director Edward Falck, of the Office of War Utilities, commenting on lifting of the order which darkened city streets as if by magic, with almost literally no exceptions, commended electric utilities, municipal authorities and consumers for accepting and abiding by one of the most striking civilian restrictions of the war. He declared that it had never been necessary in a single instance to serve an order directing an electric supplier to cut off service as a means of enforcing the Brownout.

"Now that we can shift from a two-front to a one-front war," Falck declared, "it is felt that a mandatory order is no longer required although all-out conservation of fuel in homes, offices and stores will continue to be necessary during the war with Japan."

WPB Chairman J. A. Krug, in announcing last week that the Brownout would be lifted on V-E Day, warned that:

"The end of hostilities in Europe will not solve the national coal shortage, and it may be necessary to re-issue the Brownout order some time during the fall of this year if at that time stocks of coal have not been replenished to a satisfactory level."

Probably the most striking aspect of the Brownout was the almost complete public acceptance of the order. It was no secret that OWU officials for two years dreaded the prospect of having to enforce the order, which they believed could be almost unenforceable and which they were convinced would be a back-breaking job at best.

Actually, there was relatively little trouble in administering the Brownout and obtaining 99 percent compliance. In a handful of cases, non-compliance came to the point where cut-off orders were prepared, but none ever had to be served. Numerous knotty problems had to be solved and compliance with the resulting unpalatable decisions obtained, but in retrospect, many of them were ridiculous.

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Paper Is Ammunition

Paper is scarce today because over 700,000 different war items are wrapped, labelled or made from paper or container board. The war in the Pacific increases the demand because products going to that area require double and triple packing for protection against weather and insects.

So share your ELECTRICAL WORLD; the number of copies is limited.

Keep in operation in your office and plant a continuous drive to collect all waste paper for salvage. Contribute your dead correspondence, obsolete records, useless display material, and unusable cartons.

Manufacturers Given Reconversion Ratings

Manufacturers of electric appliances from toasters to water heaters are included in the list of 72 industries to which WPB granted AA-3 ratings for reconversion tooling and construction.

The list, to be revised as the civilian production picture develops, covers industries which WPB feels will need special help if the interval between the end of war production and the start of civilian production is to be kept as short as possible. All industries on the list rate equally, and WPB's sole interest is to speed reconversion. There is no thought of complete re-tooling or construction, nor of replacing usable equipment, even though new tools or construction might add to efficiency. Estimates of reconversion needs are not even based on full civilian production but rather on a "break-even" rate of production which is felt sufficient to get industries started.

Electrical appliances included in the list early this week were domestic sewing machines, electric ranges and laundry equipment, mechanical refrigerators, electric fans, vacuum cleaners, water heaters and small electric appliances.

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North Carolina Municipals May Serve Out of Town

Any North Carolina town may furnish electricity to out-of-town customers at rates agreed upon, where such service is available, but cannot be compelled to take on undesirable customers nor those for which there are no available facilities, Attorney General Harry McMullan has ruled.

Substation Safety Theme of P.E.A. System Operators

System Operations Committee Learns of New Techniques for Long, Party-Line Types of Dispatching Circuits—Tendency for Deferred Inspections and Repair to Increase Risk of Equipment Outage Reported

Safety at substations, training of system operators now of higher average age than ever, new techniques for long, party-line types of dispatching circuits were major themes of a two-day program of the Systems Operation Committee of the Pennsylvania Electric Association in Philadelphia on May 3 and 4.

Other topics explored were more precise frequency calibrations to facilitate closer tie-line load control and better forecasts of daylight intensities. Reports indicated some easing of the reserve situation but a tendency for deferred inspections and maintenance to accentuate the risk of equipment outage. Attendance averaged forty with one quarter coming from the immediate Philadelphia area.

"Knowing Better" Dangerous

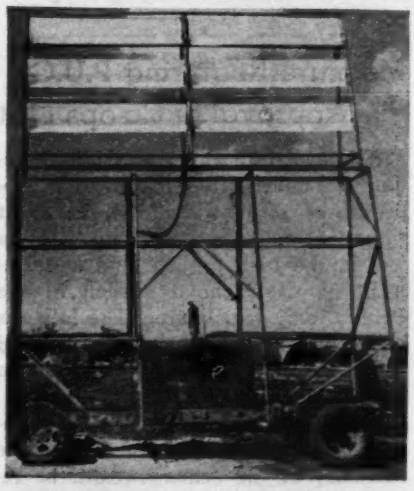
Accidents at substations have their beginning when the design is made or altered, and they are accentuated every day that experienced men believe they know better, in an habitual way, than the safety rules calculated to make them aware of the consequences of every move. This was the theme of a case discussion and model-demonstration by J. O. Leslie, director of safety, Gilbert Associates, Inc., Reading. He favored much more extensive use of barriers and asserted that there is much too much laxity with regard to grounding the apparatus worked on as well as both sides. The heart of any pole conducts, he said; fences are often too close for ladder work, switches and fuses too near buses, and load checks with encircling ammeters are fruitful hazards if made by metermen unfamiliar with substation conditions. Further, grounding platforms should not be too skimpy in area nor present high gradients to the man who steps off in case of a flash.

Seniority questions among system operators are being complicated said H. A. Dryar, chief load dispatcher of Philadelphia Electric, by manifestations among the older men of lack of confidence in their ability to assume greater responsibilities. Such confidence along with a personal inner satisfaction of doing an exacting job well at the same time as earning the favor of associates elsewhere on the system is a prime requisite, he said. It all points to the desirability of planning the training of prospective system supervisors, well ahead of the promotions. Reaction to psychological tests, he added, is better now than ever.

Big Inch Dispatching

Longest distance and busiest of the world's party lines was the designation accorded by I. E. Lattimer, A. T. & T., New York to the 4,000 miles of two-wire dispatching circuit set up to tie the 67 pumping station drops of the 1,900-mile pipe-line route into Cincinnati headquarters. Bridges, echo suppressors, carrier and amplifiers were combined to afford a faster equivalent than a teletype hook-up could have afforded for the snappy hourly reports of pressures, gravities and troubles. It was mentioned among the members that some utilities are considering proposals for adoption of similar circuits for leased dispatching.

Satisfaction was expressed with the growing collaboration with and by the Weather Bureau in rendering forecasts to utilities; this came out in a report of the joint meeting with the Weather Bureau and the hydraulic committee in Westinghouse on February 15. Five-day forecasts on a semi-weekly basis are giving promise of being more and more useful to utilities, said W. R. Hamilton, West Penn. Light values are obtained in seven degrees of intensity from the Hartford office said E. C. Brown of the Connecticut Valley Power Exchange. Others reported using arbitrary scales on a 10 and 100 range. It was evident that some uniformity would be desirable to facilitate transfers of information over interconnections. H. B. Adams of the Philadelphia weather office said the meteorologists would appreciate knowing better just what use the power companies make of the information they seek.



FOR NIGHT WORK ON TINIAN AIRFIELD—Navy workers and Seabees are using portable floodlights such as these. Units are used in series of three, with generators mounted on center units. Six troughs, each with four 200-watt lamps, are mounted in rows of two on the top section

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Truman Sees Possibility of Practical AVA Solution

President Truman told Arkansas' Gov. Ben Laney and Sens. John L. McClellan and J. William Fulbright, both Democrats, that he believed something can be worked out in a commonsense way regarding creation of an Arkansas Valley Authority. Fulbright said the President expressed interest in the matter.

Legislation to develop the Arkansas River has been before the last several sessions of Congress in varying forms. Rep. Wilbur D. Mills, Arkansas Democrat, introduced a bill, January 3, providing for development of the Arkansas and White Rivers by existing federal agencies. This bill was similar to those introduced by Mills early in 1944 and by Sen. McClellan late in 1943.

AVA legislation was introduced last January 29 by Rep. John Rankin, Mississippi Democrat, in a bill authorizing the establishment of nine regional authorities, including an Arkansas Valley Authority covering the drainage basins of the Arkansas, Red, White and Rio Grande Rivers, as well as rivers flowing into the Mississippi from the west below Cairo, Ill., and those flowing into the Gulf of Mexico from the West. Rankin introduced similar legislation in the 78th Congress.

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Utility Granted Franchise

Pacific Power & Light Co. has been granted a 25-year non-exclusive franchise by the Yakima County, Wash. commissioners to construct and operate power lines serving farms and industrial plants on the Roza reclamation project.

Lumber Availability Reconversion Factor

WPB Chairman J. A. Krug declared this week that "lumber's availability may well be the deciding factor in the partial reconversion period following V-E day."

In letters to the lumber, plywood and veneer industries he urged continuation of their "wartime record of all-out effort and the same determination which has produced lumber up to this time in needed amounts, regardless of obstacles."

Krug's statement was considered of significance to the electric power industry, directly because of the poles which will be needed under the Office of War Utilities' sanctioning of increased line building, and indirectly because of the retarding effect which scarcity of lumber would have on revived civilian production, and therefore, power sales.

WPB officials have expressed concern over lumber supply prospects in view of the immense additional quantities which will be required to handle redeployment of material now in the European theater for use in the Pacific and to handle the larger shipments which will be made directly to the Pacific theater. Lumber has been scarce for more than two years.

"Thousands of workers now in aircraft plants, shipyards and other war work should be absorbed by construction activities," Krug's letter asserted. "The expansion of many other industries is dependent on the volume of construction that may be possible."

Krug said he was "convinced" that lumber problems warrant the attention of the entire WPB and other war agencies, adding:

"The industry may expect from the lumber and other WPB divisions prompt assistance in making available the equipment and supplies needed to attain maximum production. Likewise we will continue our cooperation with other government agencies concerned with lumber production in an effort to arrive at a speedy solution of problems in the fields over which they have jurisdiction."

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OWU Authorizes Boilers

The Office of War Utilities has authorized the installation of several turbines and boilers, including:

A 37,500-kw. unit and boiler at the Harding Street station of the Indianapolis Power & Light Co., the boiler capable of turning out 400,000 lbs. of steam per hour.

A 25,000-kw. unit and two boilers for the Inglis Station of the Florida Power Corp. north of St. Petersburg.

An additional boiler, capable of generating 185,000 lbs. of steam per hour for the Rio Grande station of the El Paso Electric Co.

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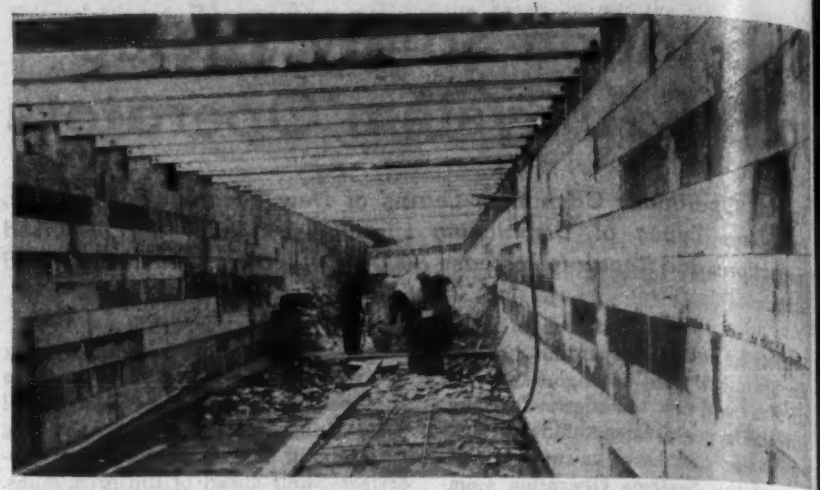

FLUME INTERIOR—New 585-ft. section of flume at Malad Power Plant of the Idaho Power Co. nears completion

Idaho Power Rebuilding Malad River Plant Flume

Reconstruction for the third time of its 4,100-ft. Malad power plant flume on the Malad River, southeast of Boise, was undertaken recently by Idaho Power Co.

A 585-ft. section was the first unit to be completed, and work of reconstructing a 900-ft. section is scheduled to start in 1947. Lumber for the section to be replaced two years hence will be purchased, treated and seasoned in 1946, said E. A. Woodhead, superintendent of the company's power plants. Replacement of the entire structure is expected to be completed by 1954.

The flume is designed to carry 900 cu.-ft. of water a second, 600 cu.-ft. of which is used in the operation of the 5000-kw. generating plant at Malad. Remainder of the water is used for irrigation purposes. Previous flume construction was expected to last from 12 to 15 yrs., but due to improvements in lumber treatment and building technique, life of the new flume is expected to be from 17 to 20 yrs.

Measure Requiring P.U.C. Approval of Co-ops Lost

A Senate bill which would have required Public Utility Commission approval of incorporation of non-profit rural cooperative electric companies was lost in the rush toward final adjournment of the biennial session of the Pennsylvania legislature. The bill was passed by the Senate and was reported favorably by the House Committee on Public Utilities.

The bill provided that articles of incorporation received in the office of the secretary of the commonwealth be referred to the Public Utility Commission. The commission would then have fixed the time and place for public hearings, given 30 days notice to proposed incorporators and other persons and corporations interested. Commission decisions could have been appealed to the Superior Court.

Idaho Power Reassures Veterans of Employment

Reassurance has been given employees of the Idaho Power Co. in the armed services by President C. J. Strike that they will not "be penalized for taking time out to defend their country".

Each honorably discharged veteran will get his old job or a comparable position. Where a veteran would have been upgraded had his service with the company not been interrupted, the company will provide special training for rapid upgrading.

Special consideration will be given those who require more than the 90-day period allowed by law for application for reinstatement. No physical examination of the returning employee will be required unless such an examination will be of help in finding suitable employment for him.

Though under the law, the 90-day period for applying for reinstatement begins in the case of veterans who have been hospitalized one year after their being discharged from active service, the company will extend this period so that no veteran will rush his hospitalization for fear of losing his job.

REA, 10 Years Old, Raised Food Output

Report by W. J. Neal Indicates That REA Drew Pattern for More Prosperous Rural Economy

Rural electrification, which has increased almost three-fold since the Rural Electrification Administration was founded ten years ago this month by executive order of President Roosevelt, has "set the pace in more efficient food production during the war and drawn a pattern for a better balance and more prosperous rural economy after the war," REA Acting Administrator William J. Neal declared this week in a tenth anniversary report.

Approximately 2,700,000 farms, almost half of the nation's total, are now electrified, the report asserted. More than half of the almost 2,000,000 farms connected in the last decade are served from REA lines.

REA's post-war plans are flourishing, according to the report, which declares that the program to complete electrification of the nation's rural areas calls for expenditure of $579,000,000 within three years after materials and manpower become available for large-scale operations. This is part of a five-year program which would bring service to 3,655,000 unserved rural consumers and which would require about $1,000,000,000 for power lines, including, of course, the $579,000,000 sought for the first three years.

The post-war expansion is in addition to a backlog of more than $100,000,000 which has been allocated but not actually advanced because of the wartime downhold on system construction. In addition, REA has on hand or under preparation applications totalling yet another $125,000,000.

Growth of REA-financed systems evidences the use to which electricity can be put on the farm, Neal said. Surveys on 21 older REA-financed systems showed an average use per farm and residential customer of 36 kw.-hr. monthly. In 1939, the last year before farm activity started climbing under the impact of war, average consumption on these systems was 62 kw.-hr. monthly, and by 1943, the eighth year of their operations, average use had risen to 92 kw.-hr. monthly.

"This trend indicates that when household appliances, plumbing and improved electrical equipment are available, the operating position of REA's borrowers will be strengthened."

REA loans have been made to 906 borrowers in 46 states, Alaska, and the Virgin Islands. Of these, 833 are cooperatives, 54 are public bodies, and 19 private utilities. Total REA authorizations to date by Congress are $525,428,288, of which $520,000,000 has been allotted. Principal and interest repayments total $90,000,000, of which $19,000,000 is prepayment.

During the fiscal year ended last June 30, REA systems sold 1,791,608,000 kw.-hr., with customers ranging from farmers to a huge aluminum plant in Arkansas, and including numerous military installations and rural industries. More than half of this energy was purchased from electric utilities, which supply 450 co-ops.

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National Resources Board Bill Proposed in Congress

A bill creating a National Resources Board, to be composed of the Secretaries of Interior, War, Agriculture and Commerce, plus seven individuals appointed by the President and confirmed by the Senate, has been introduced in the house by Rep. Cecil R. King, California Democrat.

The board would be expected to conduct studies to obtain data on natural resources of the country and to recommend plans for development and conservation of them. It would be required to cooperate and consult with other federal and state agencies, and the former would be required to lend all possible help to the board.

A similar bill has been introduced in the Senate by Pat McCarran, Nevada Democrat.

Commerce Committee Opposes Murray Bill

The Senate Commerce Committee reported unfavorably to the Senate this week on the Murray Bill to establish the Missouri Valley Authority.

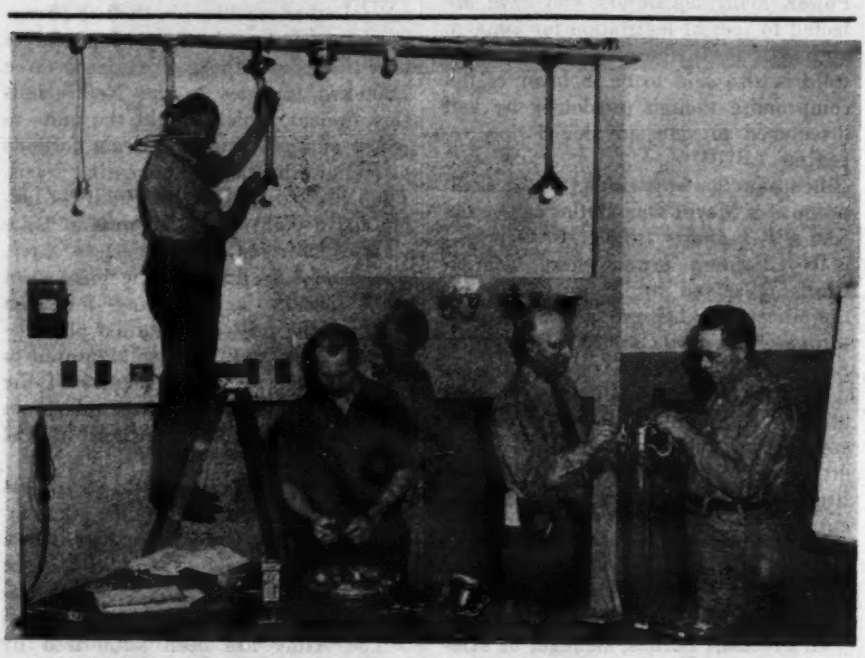
The bill immediately was referred to the Irrigation and Reclamation Committee under an agreement whereby three committees will consider the legislation for two months each.

Chairman John Overton, Louisiana Democrat, of the Commerce Subcommittee which studied flood control and navigational features of the bill, presented the report, which declared:

"The committee recommends striking from the bill all provisions relating to the proposed Missouri Valley Authority having any control whatsoever over navigation and flood control in the basin and that such control be affirmatively declared to remain, as now prescribed by law, in the War Department and under the supervision of the Chief of Engineers."

The Commerce Committee reported adversely on the entire bill, as well as the flood control and navigational features with which it had been charged. Overton declared that this was done since proponents and opponents of the measure discussed the bill as a whole before his subcommittee. Both adverse reports were unanimous.

The nomination of David Lilienthal to be a director of the Tennessee Valley Authority remained in committee early this week, with no indication of when it



SCHOOL FOR REPAIRMEN—Men of the Appliance Service Department of the Public Service Co. of Colorado are going to school to learn the proper way of repairing household fixtures, switches, and lamps. The Training Within Industry System is being followed

would be considered. His present term expires May 18.

Meanwhile, President Truman has signed the $590,000,000 Agriculture Appropriation Bill under which REA is authorized to make loans totaling $80,000,000 in the next fiscal year.

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Compromise Near In Omaha Struggle

A compromise plan to settle the power difficulties of Omaha is moving slowly, but apparently surely, through Nebraska's unicameral legislature.

The plan, still awaiting the final vote, provides for:

1. Formation of an Omaha public power district under SF310, under which the other Nebraska public power districts were organized.
2. Appointment by the governor of a board of seven directors to govern the district, with the provision that directors be elected by the people after they have served their original terms.
3. Granting of powers of condemnation to the new district.
4. A regulation that if any existing public power district seeks to purchase the Nebraska Power Co. the purchase contract must be on file with the Department of Roads and Irrigation 30 days before it is signed and executed.
5. Repeal of LB204, the 1943 Peoples Power Commission Law.

The compromise plan has the support of the present officers of Nebraska Power, many legislators who have objected to special legislation for Omaha, and local newspapers. Governor Griswold is also said to be in favor of the compromise though previously he had threatened to veto any legislation repealing LB204.

Leading the opposition to the compromise is Mayor Dan Butler of Omaha who still supports LB204.

In adjoining Iowa, where Council Bluffs is served by Nebraska Power, the citizens are beginning to debate the future of the power system in that city. Any move in Nebraska is likely to sever the Iowa properties from the parent utility. The organization of a private company to take over the Iowa properties or the formation of a Council Bluffs municipal system are being discussed.

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H. Freeman Barnes Dies

H. Freeman Barnes, manager of sales promotion of the lamp department of the General Electric Co., Nela Park, Cleveland, died on May 8. Mr. Barnes was 47 years of age.

Equipment Remains at Lake Charles Plant

Louisiana Officials Oppose Moving Turbo-Generator and Boiler to Lake Catherine, Ark., Station

Transfer of a 35,000-kw. turbo-generator and boiler from the unused Lake Charles, La., magnesium plant to the federally owned aluminum plant at Lake Catherine, Ark., had not been started early this week even though the Office of War Utilities had recommended the move early last month.

The machine is owned by the Defense Plant Corporation and had been sought by the Interior Department. OWU recommendation of the transfer was based on inadequacy of reserves in the Arkansas region. Coincident with the transfer authorization, OWU granted priorities for a 30,000-kw. unit for the Arkansas Power & Light Co. It was hoped that the DPC machine would be on the line in Arkansas by the end of the year to help carry peaks which will then be 55,000 kw. into a reserve of 70,000 kw.

Louisiana officials, headed by Sen. Allen J. Ellender, have opposed the transfer of the 35,000-kw. machine, which originally was to have been installed at Lake Catherine and which was diverted to Lake Charles to serve the magnesium plant. The unit never went into operation.

High Prices Halted Sale

Insistence by DPC on high prices for several other machines in the two powerhouses at Lake Charles is reported to have halted the sale of at least three 7,500-kw. turbines to the Nethrelands Government, which sought the units to power pumps required to drain portions of Holland flooded by retreating Nazis. The Dutch, who talked originally of taking six of eight 7,500-kw. units at Lake Charles, lowered the request to three, but reportedly dropped the idea when DPC insisted on charging for each machine the full cost installed plus dismantling charges. The total proved to be about 50 percent in excess of the price at which the Dutch could obtain adequate equipment elsewhere, it was learned.

Power installations in two plants built to serve the magnesium plant included the 35,000-kw. machine and a boiler in one plant, and the eight 7,500-kw. machines, a 15,000-kw. machine and eight boilers in the other.

The Army has been authorized by OWU to transfer one of the 7,500-kw. units to Albuquerque, N. M., where it will go to the Albuquerque Gas & Electric Co. to help handle increased Army loads, however, title negotiations for the unit had not been completed early this week. The Navy is seeking another 7,500-kw. machine and a boiler for one of its major Navy yards, and Army ordnance is seeking two of the eight boilers for a toluene plant under construction at Lake Charles.

Some of the equipment must remain at Lake Charles to meet a 22,000-kw. contract with the Gulf States Utilities Co. Additional energy will be required at Lake Charles for the Cities Service refinery which will operate the toluene plant. Also, DPC is hopeful of finding a purchaser for the Mathieson alkali works there who would require more power. It is felt that the retention of 30,000 kw. at Lake Charles would meet immediate needs for the area.

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BPA, Trades Council Sign Bargaining Pact

A long-standing dispute between Bonneville Power Administration and labor groups ended in Portland, May 2, when representatives of the Administration and the Columbia Power Trades Council signed a collective bargaining agreement.

Ranking officials of Bonneville Administration termed the agreement a "history-making milestone in Federal labor-management relations."

Under terms of the instrument, which affects various trades and crafts not governed by the 1923 Classification Act, bargaining machinery is set up to provide for joint determination of rates of pay, hours and working conditions. A system of apprenticeships, under the administration of a central joint council, is also established.

The agreement further provides for joint cooperative committees which will consider such matters as "elimination of waste in construction and production; conservation of supplies, materials and energy; improvement of quality of workmanship and services; promotion of education and training; correction of conditions making for grievances and misunderstandings; encouragement of courtesy in the relationships of employees with the public; safeguarding of health and prevention of hazards to life and property; betterment of employment conditions and the strengthening of the morale of the service."

In addition to Dr. Paul J. Raver, Bonneville administrator, and Robert B. Sheets for the Trades Council, signers of the agreement represented the teamsters', iron workers', steamfitters' and electrical workers' unions, all of which are affiliated with the Columbia Power Trades Council.

Curfew Out; Travel Restrictions Remain

War Mobilizer Fred Vinson rescinded the curfew this week but told the nation the stringency of transportation would require continued observance of transportation restrictions which ban conventions of more than 50 persons.

Outlining administration thinking on the problems of defeating Japan and getting reconversion started as promptly and as widely as possible, Vinson told a press conference that cuts in war production have begun, and in the next six months are expected to total 10 to 15 percent of the current rate. Navy cuts have already been scheduled, and greater cuts may be expected in the first half of 1946 when the pipelines of the Pacific War will have been filled. But then, munitions production will maintain a level not far from two-thirds that required by the two-front war.

Japanese war production will keep on their present jobs a great part of those now employed in war production. The total unemployed, many of whom will be only temporarily out of work, "probably should not exceed more than 2,000,000 to 2,500,000 persons at the end of the next 12 months. Severe local unemployment problems will exist side by side with manpower shortages, and strict manpower controls will continue to be necessary in such areas."

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Philadelphia Electric Co. Operating Chester Light

Philadelphia Electric Co. has acquired from the United Gas Improvement Co. all of the common stock of the Chester County Light & Power Co. and on April 25, took over the operation of the utility.

Though it will continue as a separate company for an indefinite period, Chester County Light will be operated as an integral part of the Philadelphia Electric system, under the general supervision of W. E. L. Irwin, division manager of the Main Line Division. J. F. Potts will be retained as local manager, with headquarters at Kennett Square.

The Chester company serves an area of 116 square miles, embracing Kennett Square, Avondale, West Grove, and outlying areas.

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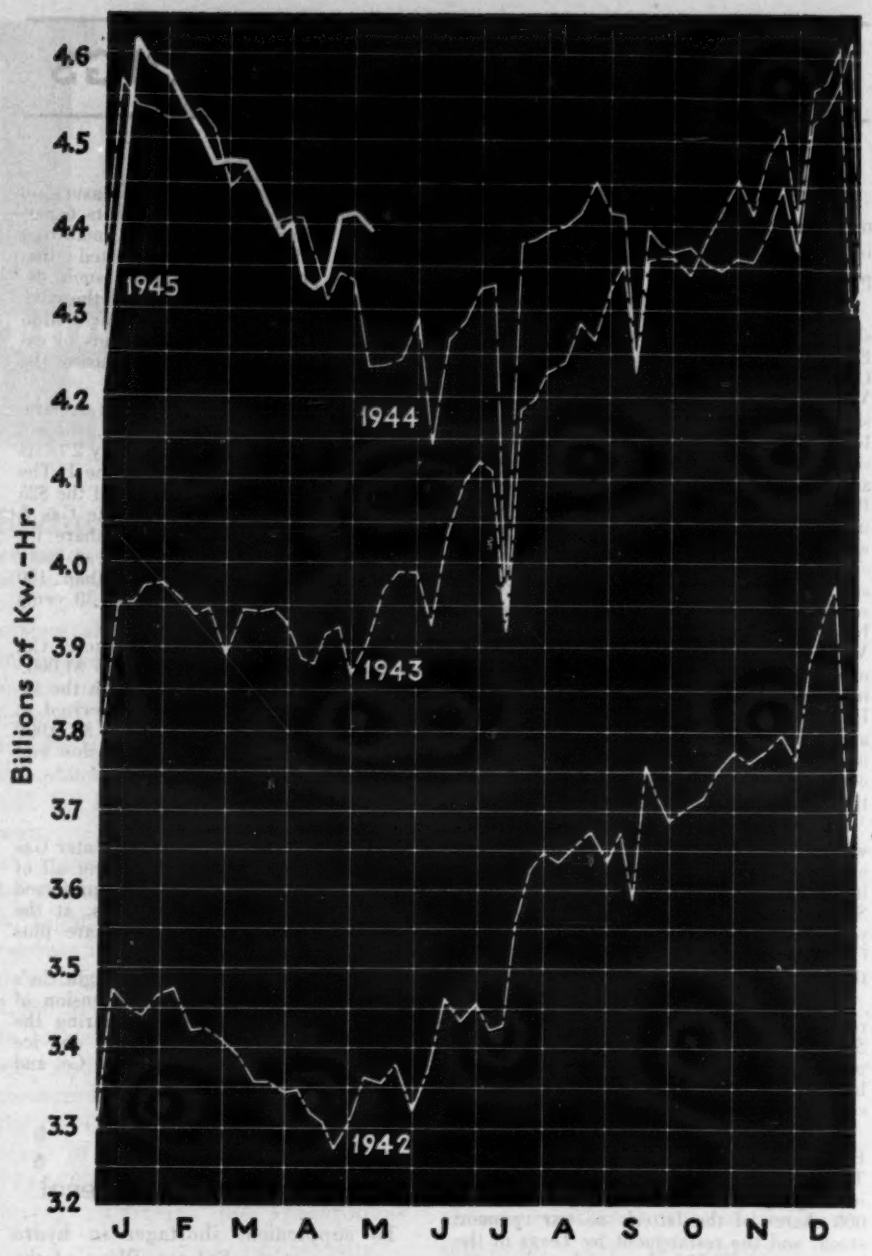
Utility To Extend Lines

To make electric service available to 95 percent of the farms in its territory, Alabama Power Co. will build 6,000 miles of rural lines following the war. The new lines in 55 counties will serve 27,500 rural and farm customers.



Output Curve Turns Downward

The electric output curve moved downward during the week ended May 5, 1945, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,397,330,000 kw.-hr., compared with 4,415,889,000 kw.-hr. during the preceding week. During the week ended May 6, 1944, the amount of electrical energy distributed amounted to 4,233,756,000 kw.-hr., this year's figure representing an increase of 3.9 percent.

All of the seven major geographic regions reported gains for the week as compared with the corresponding week of 1944, with the Mid-Atlantic and Pacific Coast groups entering the plus column. The largest increase was by the West Central States, which showed an advance of 8.5 percent.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
May 5	4,397	May 6	4,234	May 8	3,904
Apr. 28	4,416	Apr. 29	4,336	May 1	3,867
Apr. 21	4,411	Apr. 22	4,344	Apr. 24	3,925
Apr. 14	4,332	Apr. 15	4,307	Apr. 17	3,917
Apr. 7	4,322	Apr. 8	4,361	Apr. 10	3,882
Mar. 31	4,329	Apr. 1	4,409	Apr. 3	3,890
Mar. 24	4,402	Mar. 25	4,409	Mar. 27	3,928
Mar. 17	4,398	Mar. 18	4,400	Mar. 20	3,947
Mar. 10	4,446	Mar. 11	4,426	Mar. 13	3,945
Mar. 3	4,472	Mar. 4	4,465	Mar. 6	3,947
Feb. 24	4,474	Feb. 26	4,445	Feb. 27	3,893
Feb. 17	4,472	Feb. 19	4,512	Feb. 20	3,949

Percent Change from Previous Year

	Week Ending		
	May 5	Apr. 28	Apr. 21
New England	+ 4.1	+ 2.3	+ 1.0
Mid Atlantic	+ 1.6	— 3.4	— 3.0
Central Industrial	+ 5.1	+ 3.8	+ 1.7
West Central	+ 8.5	+ 7.6	+ 8.7
Southern States	+ 8.4	+ 7.7	+ 8.3
Rocky Mountain	+ 5.6	+ 5.7	+ 7.2
Pacific Coast	+ 0.4	— 2.3	— 1.6
Total United States	+ 3.9	+ 1.8	+ 1.5

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission in a series of orders recently issued affecting electric utility companies:

HAS APPROVED an amended plan for simplification of the system of the Union Electric Co. of Missouri under the Holding Company Act. Under the plan, Union of Missouri would eliminate two operating subsidiaries, Mississippi River Power Co. and Iowa Union Electric Co. by merger of Mississippi River Power into Union of Missouri and Iowa Union into Union Electric Co. of Illinois. Mississippi's properties except those in Missouri, and certain current assets would be transferred to Iowa Union in exchange for 461,000 shares of Iowa common stock. In the Mississippi River Power-Missouri Union merger the 461,000 shares of Iowa Union stock would be transferred to Missouri Union. Iowa Union would then merge with Illinois Union, and its outstanding common stock would be converted into Illinois Union common through the issuance of nine shares of Illinois Union common for every four shares of Iowa Union common, amounting to 1,107,000 additional Illinois Union shares.

EXTENDED TO July 2, 1945, the time within which Associated Electric Co. may conclude transactions incidental to the sale by its wholly owned subsidiary, Missouri Southern Public Service Co. of all its physical properties to New-Mac Electric Cooperative, Inc., for a base cash consideration of $170,000.

HAS ADJOURNED hearings on the plan for reorganization of the New England Public Service Co. to May 23 to give the company time to discuss with prospective buyers the possible sale of its industrial company subsidiaries.

APPROVED JOINT application of American Power & Light Co. and its subsidiary, Texas Power & Light Co., covering American's proposal to transfer to Texas 1,500,000 shares of the latter's no par common stock, and the restatement by Texas of the remaining 2,500,000 shares of such stock, all owned by American, at $6 a share. Texas Power will cancel the 1,500,000 shares received from American, thereby creating on its books a capital surplus of $5,000,000.

HAS APPROVED proposal of United Public Utilities Corp. to issue and sell to Bankers Trust Co., a $3,750,000 principal amount promissory note, and the payment to United by its subsidiary, Dakota Public Service Co. of $500,000 in reduction of its note indebtedness to its parent. Proceeds will be used by United, together with other funds, to redeem $4,174,000 principal amount of its outstanding bonds.

GRANTED EXTENSION of four months, to August 18, to Consolidated Electric & Gas Co., within which to bring in a plan of reorganization and has approved sale for $1,178,000 of the company's stock interest in the Florida Public Utilities Co., subsidiary. Proceeds will be used to retire parent company debt.

Applications Filed

APPALACHIAN ELECTRIC POWER CO. has asked for authorization to utilize $750,000 of "excess free cash" in its treasury to acquire for cancellation some of its 6 percent gold debentures, Series A, maturing in 2034. The application stated that $3,985,000 principal amount of such debentures are now outstanding and the company proposes to purchase and cancel additional debenture 6s as further sums of excess free cash become available during the period ending December 31, 1946.

NORTH AMERICAN CO. has filed a declaration covering its proposal to pay, subject to SEC approval, a dividend on July 2 to its common stockholders of record June 1. The dividend would be paid in shares of the $25 par value common stock of Pacific Gas & Electric Co., at the rate of one share for each 100 shares of North American common held. Those holding less than 100 shares will receive a dividend of 38 cents per share.

NEW BEDFORD GAS & EDISON LIGHT CO. has filed a proposal to issue up to $1,000,000 of notes payable to banks with the intention of using the funds thus derived to pay off its present indebtedness of $750,000 to the First National Bank of Boston and to pay for proposed improvements.

Hearings Scheduled

MAY 14: To consider General Water Gas & Electric Co.'s proposal to redeem all of its outstanding $3 cumulative preferred stock, consisting of 67,957 shares, at the redemption price of $52.50 a share plus accrued dividends.

MAY 22: On Central Power & Light Co.'s application for a six months extension of time in which to complete acquiring the Eagle Pass (Tex.) electric, water and ice property of Texas Electric Service Co. and Texas Public Utilities Co.

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Idaho Power Adds Diesel

To supplement shortages in hydro generation at the Salmon Plant of the Idaho Power Co., a 60-kw. high-speed diesel generating unit has been installed.

UTILITY REPORTS

	Net Income 1945	1944
*Arkansas Power & Light...	$2,396,987	$1,129,158
*Carolina Power & Light...	2,361,427	2,515,195
†Cleveland Elec. Illuminating and sub.....	5,781,130	6,166,211
†Commonwealth Edison and subs	22,941,300	22,490,503
†Consolidated Gas Elec. Lt. & Pwr. (Balto.) and sub..	6,491,626	6,339,382
†Idaho Power	1,380,552	1,314,890
*Minnesota Power & Light..	1,772,074	1,933,435
*Mississippi Power & Light.	1,437,569	605,845
*Montana Power	4,235,111	4,071,153
*New Orleans Public Service	1,866,861	1,747,089
*Pennsylvania Power & Light	5,544,632	5,778,028
†Philadelphia Electric and subs	17,173,044	15,400,752
†Texas Electric Service.....	1,837,421	1,776,775
*Washington Water Power and sub	2,611,764	2,944,479

* Twelve months ended February 28.
† Twelve months ended March 31.

Vancouver and Spokane Move to Get BPA Office

Two Washington cities, Vancouver and Spokane, recently initiated determined efforts to capture from Portland, Ore., headquarters of Bonneville Power Administration.

Bonneville's administrative and engineering offices, with their 837 employees, have been located in Portland since organization of the administration, and construction of Bonneville and Grand Coulee Dams.

Vancouver's plans call for the introduction before Congress of a bill appropriating $4,500,000 for an administration building, with that city specified as the site. The Vancouver claims are buttressed by government ownership of 2,000 acres of property in or adjacent to the city, purchased in the early days of the war for a housing project.

Spokane put in its bid after Vancouver started the removal movement basing its claim largely on its proximity to Grand Coulee. Bonneville budget requests for 1946 included $4,400,000 for an office building, but the item was removed because Portland's plans for a civic center remained unsettled.

•

Energy Requirements and Peak Demands Decrease

February 1945 electric energy requirements indicate a total of 17,694,174,000 kw.-hr., down about 2,195,000,000 kw.-hr. from January 1945, and a decrease of 3.5 percent from February of last year, according to preliminary figures released by the Federal Power Commission.

Preliminary figures on peak demands of the principal electric utility systems for February 1945 aggregated 37,392,935 kw., a decrease of approximately 469,000 kw. from the preceding month, but a gain of 2.8 percent over February 1944.

•

Tax Reduction Savings Go into Pension Reserve Fund

California State Railroad Commission, in a decision rendered last week, authorized Pacific Gas & Electric Co. to place in its pension reserve fund $2,567,143 of the non-recurring tax reduction for 1945, resulting from its current refunding program.

The commission ruled that the remainder of the tax saving, totaling $1,719,857, may be credited to taxes accrued as a means of meeting additional tax charges which the Treasury Department claims is due for 1941-42.

HOW

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Resonant Filter Reduces Noise

By C. S. YOUNG,
Pennsylvania Power & Light Co., Allentown, Pa.

Wartime economy has fostered many new applications of old principles; some have definite permanent possibilities; others are stop-gap expedients. An example of the latter is given in the following description of an experimental resonant shunt filter installation used to determine the possibilities of suppressing the effects of certain harmonic frequencies on open-wire Bell Telephone circuits which parallel a single phase 6.9-kv. multi-grounded rural distribution line operated by Pennsylvania Power & Light Co. In the case in question, the filter was applied directly to one phase of the distribution system in the area involved, without definite knowledge of the source of the harmonic frequencies.

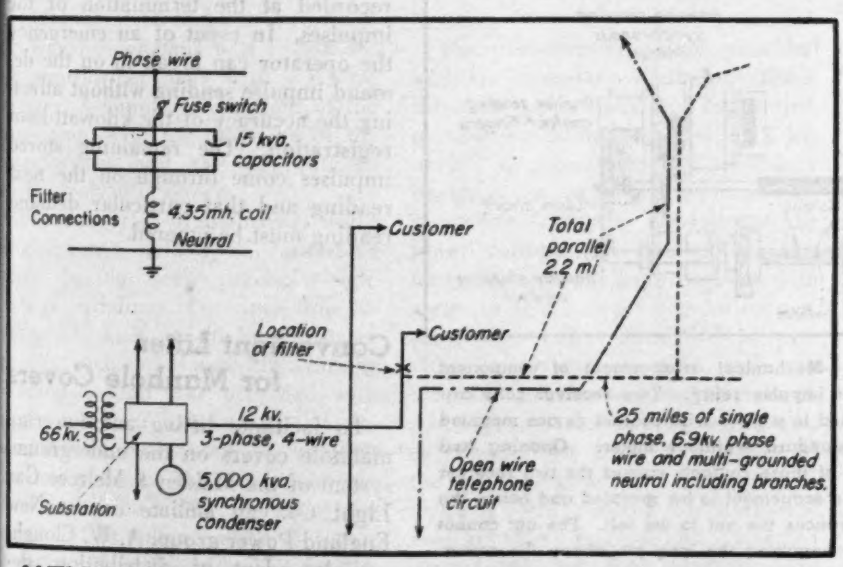
A schematic diagram of the 12-kv. system showing the location of the telephone facilities involved is shown in the figure. The telephone circuits consist largely of open-wire toll trunks, which, according to the present plans of the telephone company, will be installed in cable after the war.

In the investigation made jointly by engineers of Pennsylvania Power & Light and Bell Telephone companies, it was found that the predominant harmonic frequencies were 1,380 and 1,500 cycles. In an effort to locate the source, harmonic voltage and current components were measured in the various branches at the 66/12-kv. substation and checks made of power installations on the 12-kv. circuits over a wide area. This survey eliminated the synchronous condenser but otherwise failed to disclose any one predominant source of the harmonic frequencies.

A short cut solution was considered, consisting of the experimental installation of a resonant shunt filter* on the distribution system at the point where the single phase rural line is connected to the three phase system. In order to reduce the effects of both harmonics, the filter was tuned to 1,440 cycles. Three 15-kva., 7.2-kv. capacitors in parallel, having a total capacitance of 2.8 microfarads, were used for the capacitance portion of the filter and a modified radio frequency choke coil, having an inductance of 4.35 millihenries and originally made for suppressing radio noise on magnetite street lighting systems was utilized for the inductive section. With the resonant shunt connected as in the accompanying illustration the overall telephone circuit noise was reduced to a satisfactory level, the maximum reduction being 11 db. (3.5:1) with an average of 8 db. (2.7:1) for 14 trunks.

A test using the three capacitors without the coil, provided no appreciable noise reduction. This may be explained by the fact that the system impedance at 1,380 cycles is too low to be influenced by the 41-ohm impedance of the capacitors alone when compared to 3.8 ohms for the tuned circuit.

In making resonant shunt filter applications in the manner described, care must be exercised to avoid creating new noise conditions due to other resonance effects and to circulating harmonic currents between



6.9-KV. RESONANT FILTER cuts telephone along 2.2-mile parallel an average of 8 db., maximum of 11db., for 14 trunks

* For further details on the use of resonant shunt filters refer to Engineering Report No. 34 of the Joint Sub-committee on Development and Research, Edison Electric Institute and Bell system.

the harmonic source and the low impedance of the resonant shunt filter. In this case tests indicated no perceptible increase in noise on other circuits.

There are two contributing factors involved in this problem (1) the susceptibility of the open wire telephone circuits and (2) the electrostatic unbalance on the power system caused by the long single-phase tap to which the telephone circuits are exposed. Since the post-war plans of the telephone company include the installation of cable to replace the open wire section of line, the application of the filter described is being considered only a stop-gap measure until the telephone cable is installed.

• • •

Demand Metering Over Supervisory

By W. A. DERR,
Switchgear Engineer
Westinghouse Electric Corp., East Pittsburgh, Pa.

The recent development of the RT impulse storage relay plus a special arrangement of supervisory control circuits now makes it possible to obtain unattended, supervisory controlled station demand indication or recording as well as integrated kilowatt-hour readings over the same channel that is used for operation of the supervisory. A channel for supervisory control may be any means or medium which will allow the transmission of direct current or carrier current impulses.

This new method involves the storing of the demand metering impulses for a complete demand interval. The accumulated impulses are then released over the supervisory control channel, thereby registering on the demand dial and moving the integrating kilowatt-hour register ahead on the demand meter at the supervisory control dispatching office.

When the circuit of the impulse sending motor of the storage device is closed through the supervisory control equipment, the motor drives the cam shaft which operates the impulse sending contacts. The long pinion which meshes with the traveling nut is also on this cam shaft and the nut is thus returned to the initial position. Upon reaching this position, the nut opens the motor circuit by means of the pins projecting from the side of the nut. Any impulses received during the transmitting period will be recorded as well as those received during the storage period. No impulses are lost. The impulse sending contacts of the RT storage relay are connected to the supervisory control channel simultaneously with the closing of the impulse sending motor circuit. This allows the stored impulses to be transmitted to the WA-2 remote demand meter.

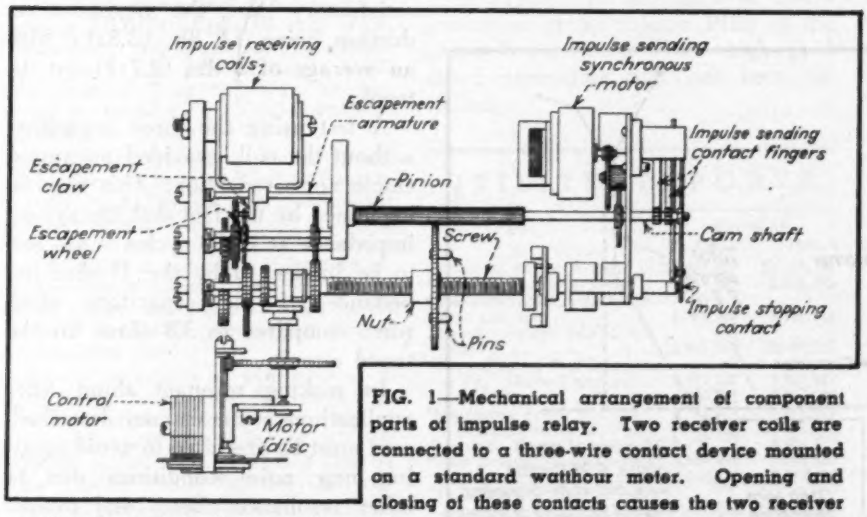


FIG. 1—Mechanical arrangement of component parts of impulse relay. Two receiver coils are connected to a three-wire contact device mounted on a standard watthour meter. Opening and closing of these contacts causes the two receiver coils to be energized alternately, causing the escapement to be operated and hence the gearing to rotate the long screw. This advances the nut to the left. The nut cannot turn because of the teeth on its periphery engaging the long pin above the screw. The necessary power for driving is obtained from the continuously energized control motor. In this manner the impulses from the watthour meter are stored

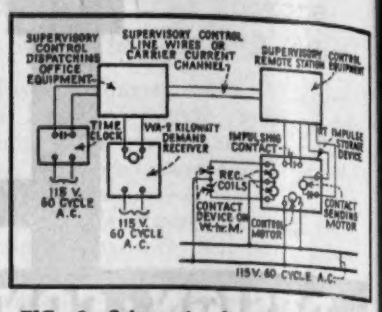

SUPERVISORY CONTROL DISPATCHING OFFICE EQUIPMENT
SUPERVISORY CONTROL LINE WIRES OR CARRIER CURRENT CHANNEL
SUPERVISORY REMOTE STATION CONTROL EQUIPMENT
TIME CLOCK
WA-2 KILOWATT DEMAND RECEIVER
IMPULSING CONTACT
RT IMPULSE STORAGE DEVICE
REC. COILS
CONTACT DEVICE ON WATTHR M.
CONTROL MOTOR
CONTACT SENDING MOTOR
115 V. 60 CYCLE A.C.
115 V. 60 CYCLE A.C.
115 V. 60 CYCLE A.C.

FIG. 2—Schematic diagram of a supervisory control circuit with impulse storage relay and impulse operated demand receiver connected

The demand receiver which is essentially a demand register driven by an impulse-operated notching relay is connected in the circuit at the dispatcher's office where the integrated kilowatt-hour and demand impulses are to be indicated.

The storage relay releases to the receiver at predetermined regular intervals an indication of the kilowatt demand. The closing of the contacts of the time clock in the dispatcher's office sets the supervisory control equipment in operation to automatically connect the impulse sending device to the line at the sending end and to simultaneously connect the receiving meter to the line at the dispatching office. Thus the impulses cause the demand pointer to move up the scale and also register the kilowatt-hours on the integrating dials of the receiver.

Should any supervised operations take place at the station while the impulses are being transmitted, the change in indication is automatically recorded at the termination of the impulses. In event of an emergency the operator can break in on the demand impulse sending without affecting the accuracy of the kilowatt-hour registration. The remaining stored impulses come through on the next reading and that particular demand reading must be ignored.

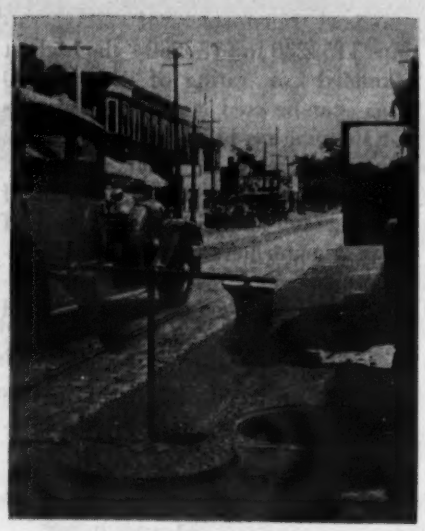
•

Convenient Lifter for Manhole Covers

To facilitate lifting and lowering manhole covers on the underground system of the Malden & Melrose Gas Light Co., an affiliate of the New England Power group, A. W. Clough, superintendent of distribution, designed a portable pipe frame stand-

rd easily handled by men in the field nd demountable to permit carrying n trucks with minimum space occuancy. The device consists of two -in. diameter solid steel rods which orm a T when in use, the horizontal ember being 36 in. long and the ertical member 26 in. high. The pper end of the vertical member terinates in a ring $1\frac{1}{8}$ in. in diameter, nd the lower end is offset $1\frac{3}{8}$ in., the ottom being welded to a circular late $6\frac{1}{4}$ in. in diameter and $\frac{5}{16}$ in. hick. This plate is provided with a adial slot $3\frac{1}{2}$ in. long and 1 in. wide. The upper bar of the T slides into he ring and about half way across s provided with a stop ring to preent its sliding all the way through he eye of the ring of the vertical od when in use.

Each manhole cover is provided ith a bolt about $\frac{7}{8}$ in. in diameter, hich is held in place permanently n the central hole of the cover, the olt head fitting about flush with the urface of the cover. The nut below he cover is threaded upon the bolt ufficiently to allow a play of about



STANDARD for lifting manhole cover also carries traffic flags

$\frac{1}{2}$ in. vertically. In using the standard, the bolt head is raised about $\frac{1}{2}$ in. and the circular flange slipped under it, after which the cover can be lifted or lowered as desired. The device provides for symmetrical disposition of loads and safe handling of covers in all weathers.

• • •

132/66 Kv. Autotransformers; Two-Winding Bank

By R. G. MYERS
Asst. Chief Engineer, Public Service Co. of Indiana, Inc. Indianapolis, Ind.

In order to permit the removal of a 12,000-kva. 66/13.2-kv. transformer bank from Lenore Substation for use at another location without completely eliminating 66-kv. reserve transformer capacity, Public Service Co. of Indiana, Inc., recently converted a 25,000-kva., 132/13.2-kv., two-winding transformer bank to a 132/66-kv. autotransformer bank with a 6.6-kv. tertiary. A simplified diagram of the substation, with the locations of the transformers and the approximate loads involved is shown.

The converted transformers were single-phase, 8,333-kva., core-type units having series-parallel high-voltage windings for operation at either 132 kv.Y or 66 kv.Y. Consequently, each end of each high-voltage winding section was provided with ample end-turn insulation and no hazard was introduced by tapping the mid-point of the series connection. One of the 132-kv. bushings now serves at that voltage, while the other is connected to the mid-point for the 66-kv. load. The mid-point connection was made on the series-parallel terminal board by disconnecting the grounded end of the winding and installing an additional connecting link, as shown in the accompanying connection diagram, without disturbing the lead from terminal board to bushing.

The transformers were provided with six secondary winding sections, three on each core leg, for series-parallel operation at either 13.2 kv. or 2.2 kv., and had six secondary bushings on each single-phase unit for current-carrying capacity at the lower voltage. The low-voltage sections on each leg were connected in series to obtain two 6.6-kv. windings, these then being paralleled to provide a circulating current path and act as a transfer winding to balance the magneto-motive force on the two core legs. The 6.6-kv. windings of the three units were then used as a tertiary delta winding for harmonic requirements. Original and converted connections of the windings are shown, as are the directions of the currents in the various windings for the two conditions.

In making the low-voltage connections, the 6.6-kv. series connections were made on the low-voltage terminal board, and each 6.6-kv. winding section was brought through a separate set of bushings. The parallel connection on each transformer, as well as the tertiary delta connection, was then made outside the transformer case. This will allow the transformers to be reconnected for 132/13.2-kv. operation (without allowing use of the 66-kv. tap, of course) without entering the case. Since only four of the six low-voltage bushings on each transformer were used for the low voltage windings, one of them could be, and was, used for the solidly grounded high-voltage winding neutral connection.

The 132 to 66-kv. impedance of the resulting autotransformer is approx-

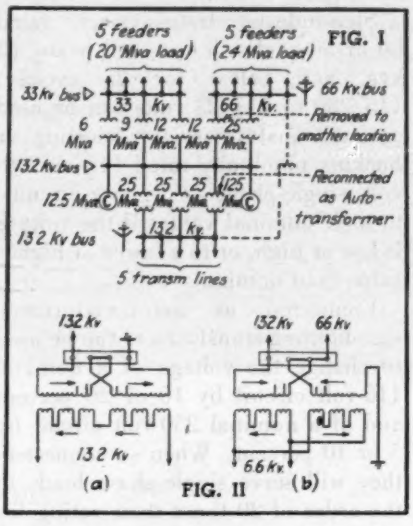


FIG. I—Reconnection of 132/13.2-kv. two-winding transformer bank as a 132/66-kv. autotransformer bank permits release of 12,000-kva. 66/13.2-kv. bank without sacrificing all 66-kv. reserve transformer capacity at Lenore substation. FIG. 2—Connection of each 8,333-kva. single-phase transformer, (a) as original two-winding transformer and (b) as an autotransformer. Arrows indicate directions of current in winding sections

imately the same as the 132 to 13.2-kv. impedance of the two-winding transformer. Both of the high-voltage winding sections have several taps, giving a multiplicity of transformation ratios. In choosing operating taps, however, care must be taken that neither winding is subjected to a higher volts-per-turn than allowed by

the designer. The kva. rating of the bank is not changed, since the 6.6-kv. winding is approximately fully loaded by its transfer function.

Dry-Type Transformers Do Special Jobs—I

By C. E. BURKE
and H. K. PRITCHARD

Specialty Transformer Section
Fort Wayne (Ind.) Works, General Electric Co.

Applications of standard, dry-type transformers to meet other than ordinary requirements from sources of power at 600 volts and below results in savings in time and in first cost and enhancement of salvage value. Several practical, yet little known, applications of transformers rated 600 volts and below will be outlined in this and the next article. Detailed discussions of the applications will be given in subsequent articles.

Sign-lighting transformers, rated 60 or 50 cycles, 5 kva. and below (2 kva. and below for 25 cycles), 115/230 to 11½/23 volts can be used as autotransformers for boosting or bucking nominally rated 115 or 230-volt, single-phase or 3-phase circuits, to their nominal values if the voltage is low or high, or to a lower or higher value than nominal.

Connected as autotransformers, sign-lighting transformers can be used to change the voltage of a nominal 115-volt circuit by 10 or 20 percent and of a nominal 230-volt circuit by 5 or 10 percent. When so connected, they will serve single-phase loads in the order of 20 times their rating for a 5 percent change in voltage, or 10 times their rating for 10 percent change in voltage, or 5 times their rating for a 20 percent change in voltage.

Two sign-lighting transformers connected as autotransformers in an open-delta bank will serve a 3-phase load of approximately 17.3 times the bank nameplate kva. rating for a 5 percent change in voltage, of 8.6 times the bank rating for a 10 percent change in voltage, and of 4.3 times the bank rating for a 20 percent change in voltage.

Standard transformers rated 60 or 50 cycles, 100-kva. and below (50-kva. and below, for 25-cycles), 230/460 to 115/230 volts, can be used as autotransformers to step up 230 volts to 460 volts. Similarly, standard transformers of voltage ratings 115/230 to 115/230—the highest standard kva. rating of which is 50 kva.—can be used as autotransformers for stepping up 115 volts to 230 volts. When so applied on single-phase circuits, they will accommodate loads of 200 percent of their rating. Two of these transformers connected as autotransformers, 2:1 ratio in an open-delta bank, will handle a 3-phase load of 173 percent of the combined nameplate kva. ratings of the two units.

It is to be noted that, except where special safety precautions are provided, autotransformers are not to be used for stepdown service on three-wire distribution voltage circuits because, in the remote case of a winding insulation failure, the higher incoming voltage will be impressed on the load circuit. Also, some localities prohibit the use of autotransformers on such circuits for either step-up or stepdown service. Consideration also should be given to transformers rated 2 kva. and below as the regulation of these units is compensated for stepdown service by making the turn ratio less than the ratio of voltage ratings.

Tensile Test Indicates Sheath Material Fitness

Soundness of cable sheath welds, tensile stress, modulus of elasticity, elongation, ductility, compression, Brinnell hardness, bending shear and uniformity are characteristics that can be measured on the new S-60 Universal Hydraulic Testing Machine at Okonite-Callender Cable Co. laboratory in Paterson, N. J. The manually operated machine provides:

1. Dead-weight load indicating system with an operating range from 120 to 12,000 lb. However, tensile strength tests are being performed with loads as low as 5 lb.

2. Location of test specimens brought close for convenience of operation and ease of observation.

3. Several scale ranges possible by using various pendulum weights.

4. Smooth, hydraulic load applications with wide variety of testing speeds. Rate of movement can be varied from zero to 8¾ in. per min.

The slow rates are used for lead and similar materials which have a relatively high creepage under tension. Faster speeds are used for fabrics, other metals, etc.

Tensile tests performed on the ma-

TENSILE TEST ON THE LEAD SAMPLE which is being examined by A. Sonntag (Sonntag Scientific) and B. B. Reinitz (Okonite-Callender Cable) was performed on the illustrated S-60 Universal hydraulic testing machine

"FAULT-SELECTIVE" FEEDER PROTECTION

Now afforded by G-E master unit substations

WHAT IT IS:

This is a proved-in-service feature that assures improved fault protection for distribution feeders. "Fault-selective" feeder protection* offers the following advantages over conventional methods:

- ✓ Disconnects branch circuits only when **permanently** faulted.
- ✓ Reduces number of fuse blowings.
- ✓ Reduces area affected by outages.
- ✓ Reduces duration of outages.
- ✓ Reduces number of service calls.
- ✓ Reduces operating cost.
- ✓ Improves continuity of service.
- ✓ Improves customer good will.

*Optional

HOW IT WORKS:

TEMPORARY FAULTS

In the event of a temporary fault at any point on the feeder or branch circuits, the feeder circuit breaker in the unit substation trips instantaneously and recloses in a fraction of a second. This breaker opening takes place before the fuse, which protects the faulted branch circuit or sectionalized portion of the feeder, can blow. Thus, *service is restored to all customers* after a momentary interruption of only a few cycles.

SUSTAINED FAULTS

In the case of a sustained fault, such as a branch-circuit conductor coming down, the feeder circuit breaker instantaneously trips and recloses as before, thus checking to determine whether the fault was temporary. The persisting fault causes the instantaneous trip to be blocked and the time-overcurrent relays to be put into operation.

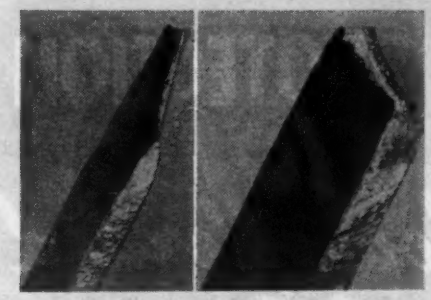
The first trip is fast, but the second is slow, delayed enough to let the fuse which protects the faulted branch circuit blow before the feeder circuit breaker opens the second time. The blowing of the fuse disconnects the faulted branch, and thus prevents the second opening of the circuit breaker.

"Fault-selective" feeder protection is only one of the extra advantages offered by General Electric master unit substations. Ask your G-E representative to give you further details. *General Electric Company, Schenectady 5, N. Y.*

UNIT SUBSTATIONS

Buy all the Bonds you can—*and keep all you buy*

GENERAL ELECTRIC



KNIFE-EDGE BREAK (left) indicates lead sample is of suitable material for cable sheath while blunt break (right) indicates unsuitability

chine indicate a relationship between the type of break obtained and the effectiveness of the material for sheath purposes. The accompanying illustration shows a typical break of two lead samples. On the left is a knife edge break which indicates the sample to be made from clean materials, properly processed in the factory and suitable for cable sheath purposes. On the right is a blunt tensile break which indicates the sample is structurally defective and lead sheath made therefrom is likely to fail in service.

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Two Forms Simplify Reports to "City Fathers"

Monthly reports to the "city fathers" have been simplified by two forms, devised by O. W. Bendorf, chief engineer of the Pitcairn, Pa., municipal electric light department, which list in detail all data on generation, sales and costs. Duplicate copies are filled in on the first of each month; one for the board and the other retained in the engineer's office for future reference when studying cost trends.

Both 8½ by 11-in. forms are shown in the accompanying illustration; the one at the left is the generation and sales report and the other, the engineer's cost sheet. On the generation and sales report space is provided for the tabulation of kw.-hr. generated per machine, plant usage, net output as well as time, date, power factor and magnitude of peak load. Consumer sales are also broken down into residential, commercial, rural, public school, hose companies, borough buildings, police department, municipal garages, and street light classifications. These constitute the department's revenue sources. Power for traffic lights, fire alarm and street lights is metered but not billed.

Space is provided for the number of meters in each customer classification and the total kw.-hr. sold in each class as well as the average income per kw.-hr. The totals for consumer sales, donations, free lighting of borough-building emergency exit lights and losses provide an easy and quick method of comparing monthly figures.

The engineer's cost sheet has tables for listing distribution of costs, analysis of costs, auxiliary equipment costs as well as the necessary data to obtain kw.-hr. losses. Distribution of cost table has two columns in which are listed the total cost figures per department or type of service and the cost per kw.-hr. The cost analysis table provides a convenient form for listing the breakdown on fuel, lubricating oil, maintenance and operative costs for the five units by totals, per kw.-hr., and percent of kw.-hr. cost. Space is also provided in the third table for auxiliary equipment and production costs.

BOROUGH OF PITCAIRN MUNICIPAL ELECTRIC PLANT

ENERGY REPORT FOR _____

Kilowatt Hours Generated:

No. 3 Gas Engine	_____	Peak Load	(_____)
No. 4 Gas Engine	_____	P. F.	(_____)
No. 5 Diesel	_____		
No. 6 Diesel	_____	Date	(_____)
No. 7 Diesel	_____	Hour	(_____)
Total Generated	_____		
Less Plant Use	_____		
Output or Payload	_____		

CONSUMER SALES

Class	Number of Meters	Total of Meter Rdgs.	Cash For Month	Average Per Kw.-Hr.
Residential				
Commercial				
Rural				
Public Schools				
Municipal:				
Hose Company #1				
Hose Company #2				
Borough Bld'g				
Police Dep't				
Garages				
Street Lights				
TOTAL PAY LOAD				
Free Donations:			free	free
Traffic Lights			"	"
Fire Alarm			"	"
American Legion			"	"
Total - FREE DONATIONS			"	"

CONSUMER SALES _____ kw.-hr.
FREE DONATIONS _____ kw.-hr.
FREE LIGHTING _____ kw.-hr.
LOSSES _____ kw.-hr.
TOTAL _____ kw.-hr.

Municipal Light Plant - Engineers Cost sheet for month of _____

Kw.-hr. generated..... _____ Meter readings.... _____
Kw.-hr. Plant use..... _____ Street lighting... _____
Kw.-hr. "Output" ..... _____ Free donations.... _____
Losses..... _____ Accounted for..... _____

PEAK LOAD— _____ POWER FACTOR— _____ Day.. _____ TIME. _____

DISTRIBUTION OF COSTS

Generating dept.....	$ _____	Per Kw..	_____
Distribution.....	_____	"	_____
Administrative.....	_____	"	_____
Total Operating	_____	"	_____
BOROUGH FREE SERVICES.....	_____	"	_____
Distribution.....	_____	"	_____
Loss estimate.....	_____	"	_____
Assumed cost.....	_____	"	_____

COST ANALYSIS

	Production Kw.-Hr.	$	Fuel	Lub.oil	Labor Maint.	Oper.	Total	Per Kw.-Hr	$ Kw.-Hr
#3									
#4									
#5									
#6									
#7									

AUXILIARY COSTS

Kw.-Hr.	% Total	Labor	Supplies	Cur.Avg.	Total	Output	Avg.

Diesel costs _____ Av. Production cost _____
Gas costs _____ Aux. per Kw.-Hr.output _____
Combined cost _____ Output Production _____

_____ Chief Engineer

GENERATION AND SALES REPORT (left) and engineer cost sheet (right) reveal complete output and cost data to municipal authorities. Both are 8½ by 11-in. forms which are filled-in in duplicate on the first of each month

—low-pressure gas-filled cable for 10 to 40-kv service will be comparable in economy with solid-type insulated cable, with the added advantage of self-supervision

—A.I.E.E. Transactions—1939

G-E STUDIES FORECAST IT

FIELD EXPERIENCE CONFIRMS IT

More than 250,000 feet of gas-filled cable (10 to 40 kv) now operating. More installations planned

EVERY installation of G-E low-pressure gas-filled cable has proved the accuracy of that forecast. Installations considered experimental when made by utilities five years ago are now accepted as setting the pattern for many of their future cable runs. To date, there has been no cable failure, no insulation deterioration. Gas-filled cable and solid-type insulated cable *are* comparable in economy, but gas-filled cable offers not only self-supervision in addition, but other advantages as well.

SELF-SUPERVISING *Plus*

In addition to the self-supervision feature, which guards it against failure following sheath damage, gas-filled cable has the ability to withstand overloads with a greater margin of safety. Ionization is self-extinguishing, even at levels of voltage stress higher than normal working-voltage stresses.

EASY TO INSTALL

With gas-filled cable, profile of the installation is no longer a problem, because there is so little compound migration. Joints can be made with essentially the same technique as for solid-type cable. A simple nitrogen-gas cylinder, equipped with valve and pressure relay, maintains gas pressure in runs up to 40,000 feet.

For further information on low-pressure gas-filled cable, ask for Bulletin GEA-3652. *General Electric Company, Schenectady 5, N. Y.*

RATINGS: Low-pressure, 10 to 40 kv; Medium-pressure, 40 to 69 kv

GENERAL ELECTRIC

GAS-FILLED CABLE

Buy all the BONDS you can—*and keep all you buy*

METER CONNECTIONS FOR MEASURING REACTIVE COMPONENTS

By H. W. BRUCE, Engineer, Department of Water and Power, City of Los Angeles

Kilowatt-hours (kw.-hr.) and kilovolt-ampere reactive hours (kvarh.) for average power factor determination can be measured by accompanying meter combinations. The connection diagrams, covering meters, auxiliaries and lines, have been adapted as electrical standards by the Department of Water and Power, City of Los Angeles.

Power components measured by the combinations of meters and auxiliary devices in the connections diagrams are:

In Fig. 1, kw.-hr., kw. (indicated) demand and kvarh.

In Fig. 2, kw.-hr., kw. (recorded) demand and kvarh.

When single-disk polyphase meters are used, either A-base or S-base, the right element on the connection diagram corresponds to the upper element of a two-disk meter, and the left element corresponds to the lower element.

Meter connections are made according to the corresponding color coded wires.

When potential transformers are used the potential leads are connected as shown by dotted lines.

A plus sign (+) indicates polarity marks.

Instrument transformer frames are to be grounded.

If kvarh. meter rotates backwards on lagging power factor, interchange leads AB and CD on phasing transformers.

Color legend:

Bk = Black
Bl = Blue
Br = Brown
G = Green
R = Red
W = White
Y = Yellow

§

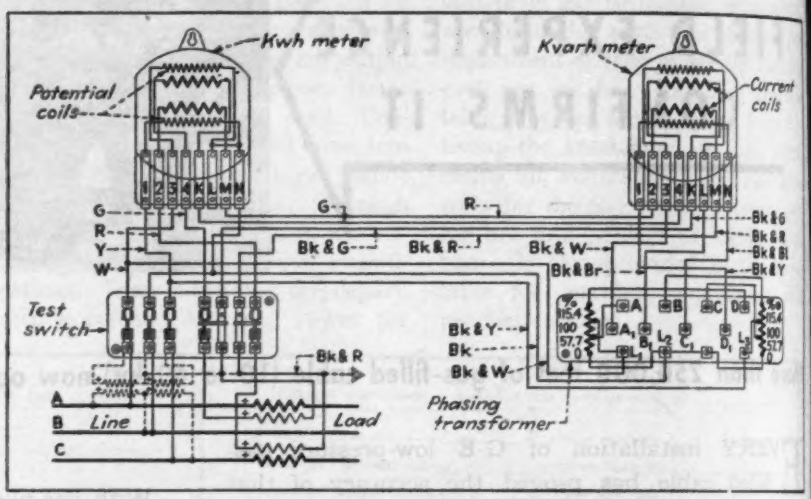


Fig. 1—(Left) Bottom-connected Sangamo watthour meter (with a meter test switch) to measure kw.-hr. and indicated kw. demand. (Right) Same type of meter, but with phasing transformers connected, to measure kvarh. The phasing transformers are equipped with a four-pole, double-throw switch. Normal position of switch is up and when used for testing the switch should be down

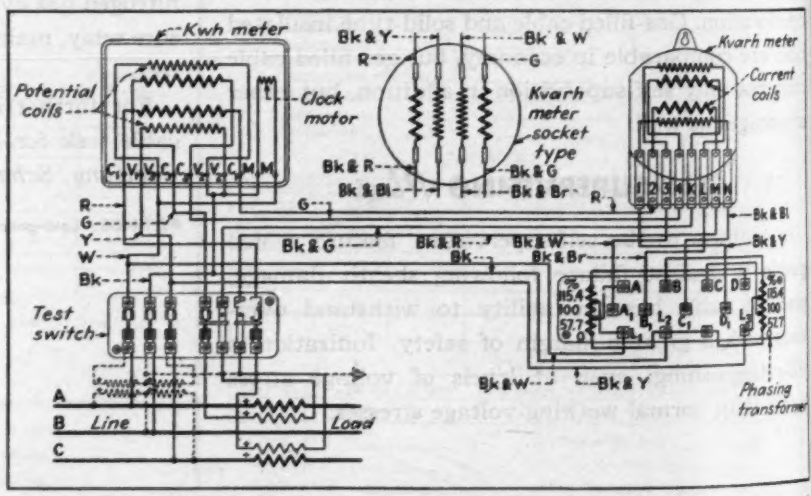
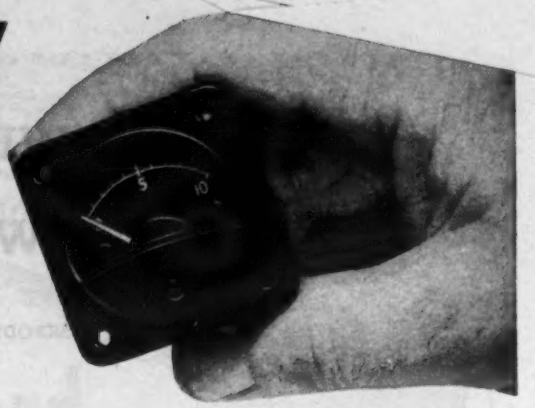


Fig. 2—(Left) Westinghouse meter (with a meter test switch) for measuring kw.-hr. and recorded kw. demand. (Right) Bottom-connected Sangamo meter as in Fig. 1 (right) for measuring kvarh. (Center) Connection designation for socket type meter

Here They Are!



The New 1½ INCH G-E PANEL INSTRUMENTS

To meet the need for compactness, especially in electronic and communication devices for combat, they have a body diameter of only 1½ inches, are less than 1 inch deep, and weigh only 3 ounces. They are accurate to within ±2 per cent.

These instruments are of the internal-pivot construction, and in addition to small size and light weight, they have all the other desirable features associated with this unique G-E design.

Because of its high torque and large-radius pivots, the element (which is common to both instruments) is well able to withstand vibration. High torque combined with a lightweight moving element results in fast response. Good damping makes for ease and accuracy of reading. Large clearances help to insure reliable operation.

All these features add up to a high factor of merit and all-round excellent performance.

For advance information, ask the nearest G-E office for Booklet GEA-4380, or write to General Electric Co., Schenectady 5, N.Y.

WATERTIGHT

TYPES DN-1, -2, -3
(Left hand, above)

● For applications where equipment may be used in an extremely humid atmosphere, exposed to rain, or accidentally submerged in water. Available for direct-current (DN-1), radio-frequency (DN-2), and audio-frequency (DN-3) service.

CONVENTIONAL

TYPES DN-4, -5, -6
(Right hand, above)

● For use on aircraft and on communications or electronic devices where the instrument is protected. Available for direct-current (DN-4), radio-frequency (DN-5), and audio-frequency (DN-6) service.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

Buy all the Bonds you can—*and keep all you buy*

THEY'RE G-E INTERNAL-PIVOT INSTRUMENTS

One advantage of the internal-pivot design is compactness. Armature, core, control springs, pivots, jewels, balance weights, and pointer form a single, self-contained unit, all parts of which are supported by a cast-comol magnet.

GENERAL ELECTRIC

POWER MEASUREMENT BY "n-1 WATTMETER" METHOD

By C. E. SKRODER, Assistant Professor of Electrical Engineering, University of Illinois, Urbana, Ill.

Simplified demonstration of the Blondel theorem that the power supplied to any load by n conductors such as a mesh or star connected load of a polyphase system, can be measured by n-1 wattmeters

The proof that n-1 wattmeters are sufficient to measure the power is based upon the fact that after the load has been connected, the power delivered to it is determined by the line voltages regardless of the nature of the source of these voltages. This being the case, the real source may be assumed to be disconnected and n-1 imaginary generators with a common return substituted for it as shown in the illustration. The only requirement of these imaginary generators is that after being connected they shall establish at their terminals voltages which are identical from instant to instant to the voltages that existed between the lines before the substitution was made. That this requirement can be fulfilled by the n-1 equivalent generators can be readily shown.

By the hypothesis

terminal voltage of generator 1,

$$v_1 = v_{AN}$$

terminal voltage of generator 2,

$$v_2 = v_{BN}$$

terminal voltage of generator 3,

$$v_3 = v_{CN}$$

.....

terminal voltage of generator n-2,

$$v_{n-2} = v_{LN}$$

terminal voltage of generator n-1,

$$v_{n-1} = v_{MN}$$

The original line voltages v_{AN}, v_{BN}, v_{CN},.....v_{LN} and v_{MN} being maintained by the equivalent generators, it is now necessary to show that the other line voltages, namely, v_{AB}, v_{BC},..... and v_{LM} are also maintained.

Referring to the diagram it is seen that

$$v_1 - v_2 = v_{AB} \quad (1)$$

$$v_2 - v_3 = v_{BC} \quad (2)$$

.....

$$v_{n-2} - v_{n-1} = v_{LM} \quad (3)$$

Also

$$v_{AB} = v_{AN} + v_{NB} = v_{AN} - v_{BN} \quad (4)$$

$$v_{BC} = v_{BN} + v_{NC} = v_{BN} - v_{CN} \quad (5)$$

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$v_1 = v_{AN}$, $v_2 = v_{BN}$, $v_3 = v_{CN}$,..... $v_{n-2} = v_{LN}$ and $v_{n-1} = v_{MN}$; thus Equations (4), (5), and (6) may be written

$$v_{AB} = v_1 - v_2$$

$$v_{BC} = v_2 - v_3$$

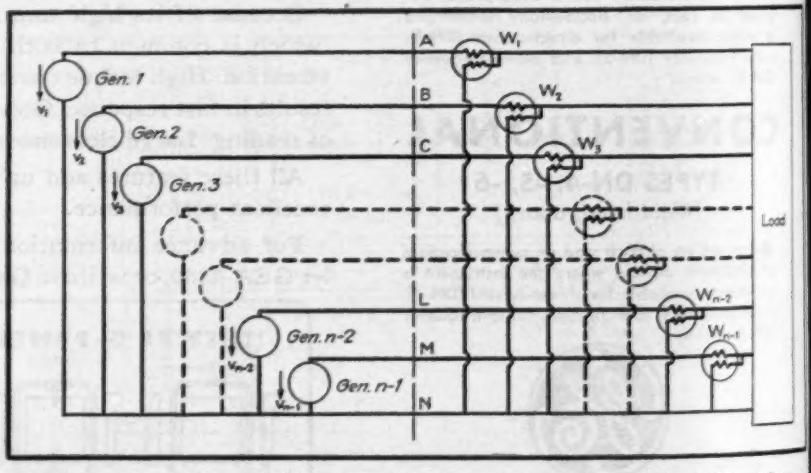
.....

$$v_{LM} = v_{n-2} - v_{n-1}$$

These equations are identical to Equations (1), (2), and (3), and it is proved that the line voltages v_{AB}, v_{BC},..... and v_{LM} remain unchanged after the substitutions of the equivalent generators.

The substitutions of the equivalent generators having left the line voltages undisturbed, no change of the power delivered to the load can have taken place as a result of this substitution for the original source. The equivalent generators may therefore be assumed to supply the power. To determine the power, it is only necessary to measure the power delivered by each of the equivalent generators as indicated by the wattmeters shown in the illustration. There being n-1 equivalent generators, n-1 wattmeters are then sufficient to measure the power.

In the foregoing method no restrictions have been imposed. The voltages may be of any magnitude and waveshape, and the load may be of any number of interconnected elements. It is important, however, that the system be an interconnected one; that is, it shall be possible to trace a continuous path from any selected terminal of the load to any other load terminal either through the load or through the actual source. If this condition is not met there exist two or more isolated systems, and the n-1 wattmeter method must be applied to each of these systems.



POWER SOURCE connected to a load by n conductors can be replaced by n-1 generators and the power measured by n-1 wattmeters

How far can you afford to transport KILOVARS?

Seldom as far as you carry the kilowatts

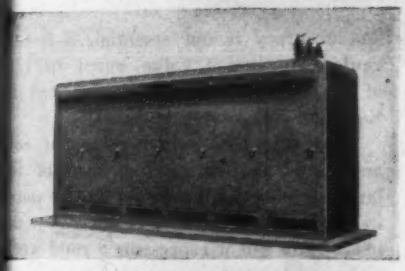
Here's why: The distance that *kilowatts* can be transmitted *economically* to remote loads has changed but little in the last few years, but a great reduction has taken place in the economic transmission distance for *kilovars*.

This reduction is a result of the greatly reduced cost of supplying kilovars near the load area by means of capacitors.

If it cost nothing to supply your kilovar requirements *at the load*, it would be uneconomical to transmit kilovars even as far as your first transformer, because of the system investment that is eaten up in transmitting them. The transmission of kilovars a great distance usually means larger transformers, copper, and other circuit elements. Then, too, the traveling kilovars cause I^2R losses, which drain off companion kilowatts before they reach the payload, as well as I^2X losses.

Naturally, even with capacitors, it still costs something to supply kilovars at the load. But the cost of "on-the-spot generation of kilovars" with capacitors has been reduced during the past 15 years to about one-quarter of the original figure. Hence, a general answer to the question "How far can you afford to transport kilovars?" is this: "Only one-quarter as far as you did 15 years ago." Consideration of this fact may help you meet the ever-present challenge to produce lower-cost power.

We will be glad to help you analyze your kilovar requirements and estimate the benefits of Pyranol capacitor banks on your system. Ask for Publication GEA-4225. *General Electric Company, Schenectady 5, N. Y.*



Attractively styled Pyranol capacitor equipments with or without switchgear are now available for supplying your bulk kilovar requirements. Large outdoor banks can be made up easily out of a number of equipments similar to the 2520-kva equipment shown (houses 168 separate 15-kva capacitor units).

PYRANOL CAPACITORS

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GENERAL ELECTRIC

407-87-5700

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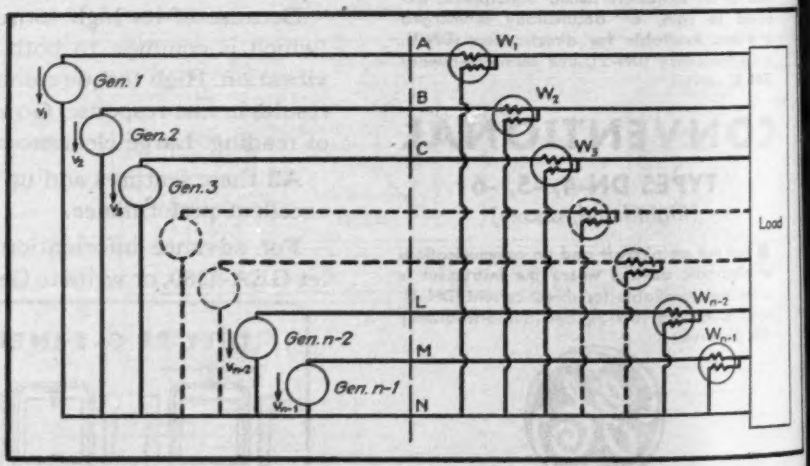

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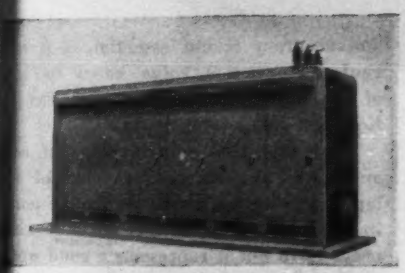

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GENERAL ELECTRIC

407-87-5700

HOW TO DETERMINE FILAMENT RESISTANCE OF TUNGSTEN LAMPS

Tungsten filament of an incandescent lamp offers less resistance to the flow of electric current when cold than when it is hot. The spread between the hot and cold filament resistance is treated in the accompanying curve and data, useful in connection with employment of lamps as resistors. This information has been developed by Earle Benson, Commercial Engineer, Sylvania Electric Products, Inc., Salem, Mass.

Curve shows the increase in resistance as a filament becomes hotter due to increase in voltage. The difference between the hot and cold resistance is shown in percentage of the resistance of a filament which is operated at its rated voltage. This curve is drawn on the basis that at rated voltage, i.e. 100 percent rated volts, the filament offers 100 percent resistance, and as the voltage is decreased below the rating of the lamps, the percentage of resistance offered decreases.

Rated or hot resistance of a filament may be calculated by Ohm's law from the lamp rating, as follows:

$$R_R = \frac{V^2_R}{W_R} \qquad (1)$$

where R_R is rated resistance; V_R is rated voltage; W_R is rated wattage.

Resistance of a filament at various temperatures, as determined by the voltage at which it is operated, can be calculated by the following equation:

$$\frac{V^{3.4}_O}{V_R} = \frac{R^{1.4}_O}{R_R} \qquad (2)$$

where V_O is operated voltage; V_R is rated voltage; R_O is operating resistance; R_R is rated resistance.

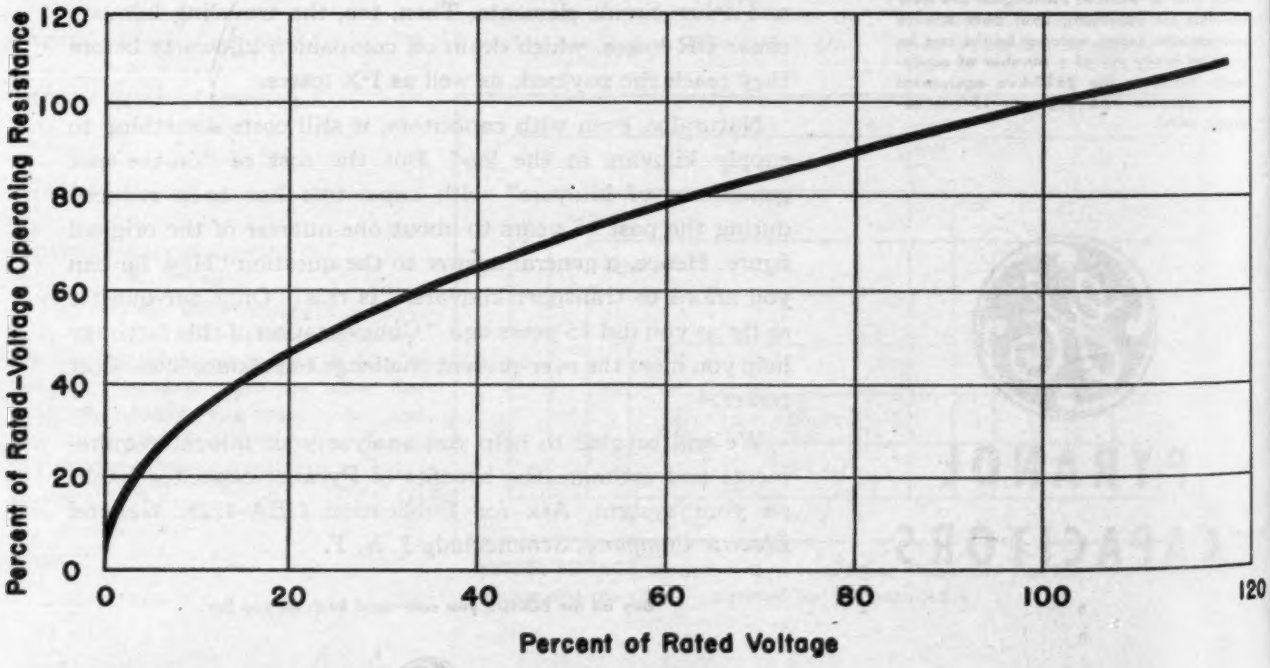
This equation is, of course, general. An accurate treatment requires different exponents for each type of lamp. However, for ordinary incandescent lamps this method will give quite satisfactory results.

If just the cold resistance is desired and accuracy is not essential, it is convenient to use a value equal to 1/15 of the hot resistance as calculated by Equation (1).

The table lists actual values of cold and rated resistances for some of the lamps in common usage. As will be noted in the last column, 15:1 is not always the exact ratio but it represents a good working round number.

Resistances of Incandescent Lamps With Tungsten Filament, Rated 120 Volts

Lamp Rating, watts	Cold Resistance, ohms	Resistance at Rated Voltage, Burning, ohms	Ratio of Resistances, hot:cold
25	44.1	576	13.1 :1
40	25.2	360	14.3 :1
60	17.2	240	14.0 :1
100	9.82	144	14.7 :1
200	4.78	72	15.1 :1
500	1.79	28.8	16.1 :1
750	1.29	19.2	14.9 :1
1000	0.96	14.4	15.1 :1



RESISTANCE of tungsten lamp filament in relation to operating voltage

New! Free-Cutting Copper Rod

...by Revere increases production

To meet the demand of the electronic and electrical industries, the welding equipment field, and in fact of all companies needing copper of improved machinability, Revere now offers Revere Free-Cutting Copper Rod.

This is oxygen-free, high conductivity copper containing a small amount of tellurium, which greatly increases the speed with which the metal can be machined, makes it possible to hold to closer tolerances, and improves the finish of the completed parts. Electrolytic copper, while suitable for many purposes characteristically machines with long tough stringers which are difficult to remove. Free cutting copper chips are brittle and break readily, clearing from the tools without attention.

These advantages increase production rates, depending upon the amount of machining necessary on each given part. Consequent lowered costs may be an important factor to you.

Revere Free Cutting Copper Rod is available in sizes up to 2" and in all the usual shapes. For details, write the Revere Executive Offices.

CUSTOMERS REPORT:

"This material seems to machine much better than our previous hard copper bar; it cuts off smoothly, takes a very nice thread, and does not clog the die." (Electrical parts.)

"Increased feed from 1½" to 6" per minute and do five at one time instead of two." (Switch parts.)

"Spindle speed increased from 924 to 1161 RPM and feed from .0065" to .0105" per spindle revolution. This resulted in a decrease in the time required to produce the part from .0063 hours to .0036 hours. Material was capable of faster machine speeds but machine was turning over at its maximum. Chips cleared tools freely, operator did not have to remove by hand." (Disconnect studs.)

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Avenue, New York 17, N. Y.

Automatic Line Transfer for Suburban Substation

By H. F. BÉIQUE
Superintendent Power Division, Quebec Power Co., Quebec

In order to take care of the electrical service to new residential districts, the Quebec Power Co. has built a radial distribution substation which embodies an interesting automatic line transfer scheme.

This substation consists of three transformer banks, two of which are 3-phase, 5,000-kva., 60/kv., feeding a 4-kv. distribution bus; the third bank consists of three 1,000-kva. 60/25-kv. units and serves two 25-kv. feeders.

The 60-kv. bus is either fed from Montcalm 60-kv. line or from No. 12 line. Two motor-operated air break switches (Fig. 1) are provided to disconnect the 60-kv. bus from either of these lines or from both. The preferred feed is the Montcalm line which is a short 60-kv. feeder emanating from the main Quebec Terminal Station. The emergency feed consists of a tap off No. 12 line which is some 75 miles long and which extends between Quebec Terminal Station and a power house in the Shawinigan area.

FIG. 3—Instrument panel includes the two control switches (at top), one for Montcalm line motor-operated disconnect and the other for No. 12 line. The two glass-covered relays are not treated in the accompanying discussion

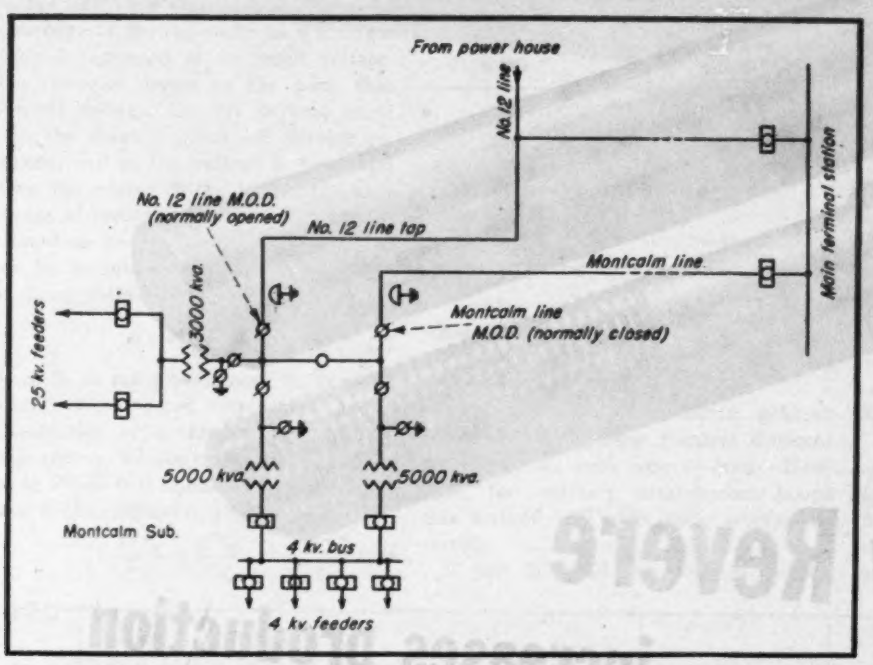


FIG. 1—Schematic diagram of two-source supply to suburban substation arranged for automatic throw-over. M.O.D.-motor-operated switches

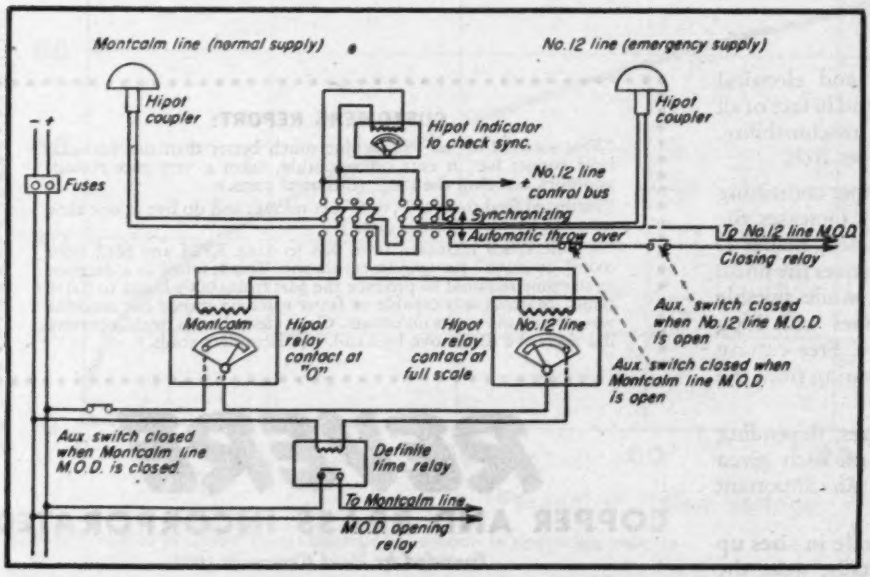

Montcalm line (normal supply)
No. 12 line (emergency supply)
Hipot coupler
Hipot coupler
Hipot indicator to check sync.
Fuses
No. 12 line control bus
Synchronizing
Automatic throw over
To No. 12 line M.O.D. Closing relay
Aux. switch closed when No. 12 line M.O.D. is open
Montcalm
Hipot relay contact at "0"
Hipot relay contact at full scale
No. 12 line
Aux. switch closed when Montcalm line M.O.D. is open
Aux switch closed when Montcalm line M.O.D. is closed
Definite time relay
To Montcalm line M.O.D. opening relay

FIG. 2—Automatic line transfer scheme based on capacitive couplers

Conditions to be Met

The following conditions had to be taken care of:

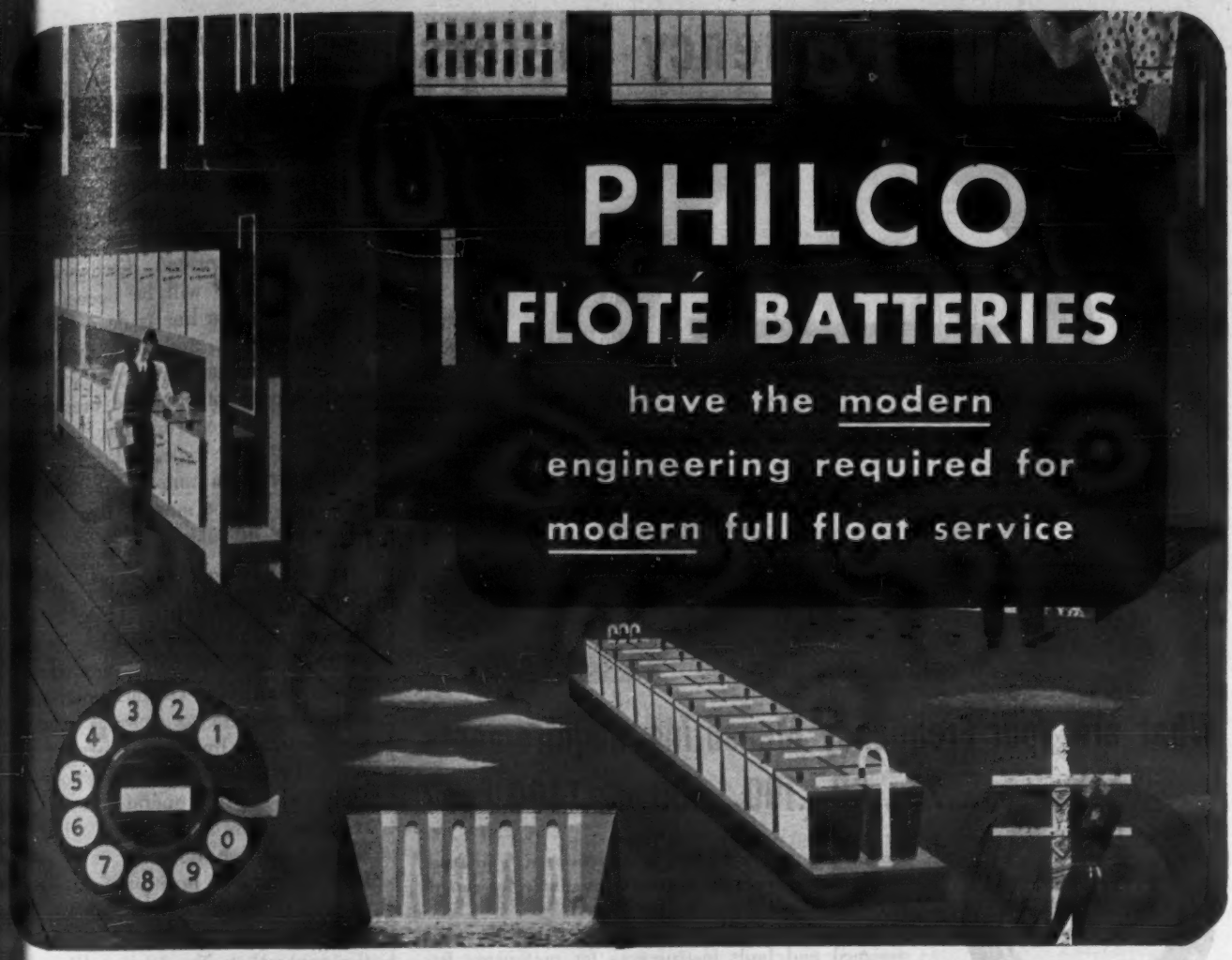
1) An automatic line transfer scheme to switch the Montcalm substation load over to the emergency feed in cases of permanent trouble on the Montcalm line, after allowing instantaneous single reclosure to take place on the breaker serving that line at the main Quebec Terminal Station.

2) Unnecessary transfer in cases where both Montcalm line and No. 12 line would go dead because of a system shake-up.

3) Normal service off the Montcalm line was to be restored manually by closing Montcalm line motor-operated disconnect and then opening No. 12 line motor-operated disconnect.

4) Check the state of synchronism between the two in-feeds before above operation can be carried out.

The above conditions were met easily and simply with the use of two (Berlec) Hipot capacitive couplers installed at Montcalm substation, one on the Montcalm line and the other on No. 12 line emergency supply. The signal from these two Hipot couplers after going through two properly arranged telephone keys is sent to two Hipot contact-making relays, one for the Montcalm line making contact at O on the scale and the second for No. 12 line, making con-



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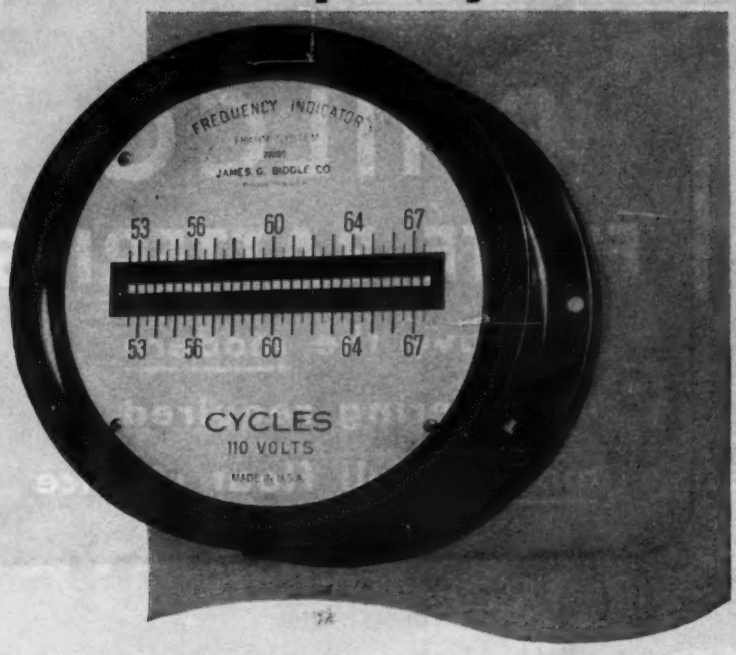
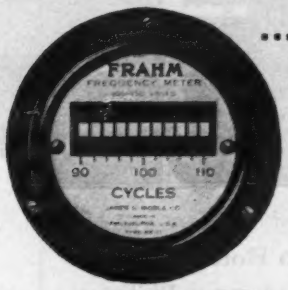
For 50 years a leader in Industrial Storage Battery Development

"FRAHM" Frequency Meters



What are your Frequency Measuring Requirements ...25...60...100...400.....1400 cps?



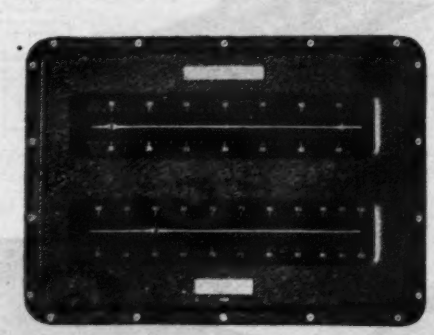
Frahm Frequency Meters in switchboard, miniature and portable types are regularly available for ranges between 15 and 500 cycles per second.

To meet special requirements, our laboratory has designed and built instruments for measuring frequencies as high as 1400 cycles. Such, we find, is possible by means of the same simple and direct resonant reed principle, usually requiring less than 0.1 volt-ampere power input, and without recourse to intermediate frequency conversion equipment. We believe that even higher frequencies are possible.

We invite correspondence regarding any frequency measurement problem in the audio and sub-audio range. For its solution we proffer our instruments, our services and facilities. In our 30 years of association with the resonant reed principle as applied to the measurement of frequency, we have been instrumental in the solution of a surprising variety of problems.

Write for Bulletin 1770-W now in preparation.

This instrument was developed for direct indication of frequencies in the lower audio range and for simultaneous direct indication of harmonic components. Called a Harmonic Analyzer, it has unusual electrical characteristics and a wide range, with a total of 288 reeds.



JAMES G. BIDDLE CO. 1211-13 ARCH STREET PHILADELPHIA 7, PA.

tact at full scale reading. The two auxiliary contacts on the Hipot relays (Fig. 2) are connected in series to actuate a definite time relay which in turn operates the Montcalm line motor-operated disconnect opening relay. Thus it will be seen that with the two 4-pole telephone keys depressed, the motor operated disconnect on Montcalm line will be opened only when Montcalm line is dead and No. 12 line is alive, and this only after a definite time has elapsed sufficient to allow the Montcalm line breaker at the main Quebec Terminal Station to carry out its single reclosure. This will prevent automatic transfer in cases of non-permanent troubles on Montcalm line.

Manual Adjuncts

To the right centre, (Fig. 2) are shown two auxiliary switches located in the motor-operating mechanism which cause No. 12 line motor-operated disconnect to close as soon as the Montcalm line motor-operated disconnect reaches the full open position. Only when the operator wants to transfer back from No. 12 line to Montcalm line does he raise these keys to neutral position taking care always to raise No. 12 line key before Montcalm line key so as to break the contact on No. 12 line Hipot relay.

By raising one or the other of the telephone keys (Fig. 2) it can be ascertained if each line is energized; also that by raising both keys simultaneously the Hipot indicator will show if the two lines are in synchronism or out of synchronism. This information is especially useful to the operator when he wants to transfer the load of the Montcalm substation from No. 12 line emergency supply to the normal supply.

•

Vector Analysis of Meter Connection—III*

By NICHOLAS B. COOK
Public Service Electric & Gas Co.
Paterson, N. J.

How is the registration of a watt-hour meter affected by leaving the neutral tap open at the meter? This problem is solved in this article by application of the methods described in the two previous articles and by as-

* Concluding the series of articles which began in the ELECTRICAL WORLD on April 14, 1945, page 122.

Only TIREX HAS THE Selenium RUBBER ARMOR

Only Simplex-TIREX has the famous Selenium Rubber Armor for its jacket. This famous jacket is well known wherever tough, hard jobs are to be done, regardless of whether it is in coal mining, ship building, in stripping operations, in rock quarries or in foundries. Selenium Rubber Armor made with synthetic rubber is becoming as famous as the prewar armor made with natural rubber. Wherever rough, abrasive conditions are found, there are the jobs that TIREX excels at doing.

Actual service tests show that the Selenium Rubber Armor lasts so long that TIREX cables have proved in the long run to be by far the most economical.

Whenever your requirements call for the use of a portable cord or cable, remember that the tough Selenium Rubber Armored TIREX Cord and Cable is the one to help keep your costs down and insure dependable operation.

TIREX SELENIUM Rubber Armor

Unequalled for Long Life, Toughness and Resistance to Abrasion.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

ARMY E NAVY

Simplex WIRES and CABLES

NINE "S.A." BOILERS FOR ONE

1st Unit Ordered in 1941
9th Unit Ordered in 1945

ACTUAL experience with the first unit proved that this design of boiler demonstrates in operation the advantages that are claimed for it.

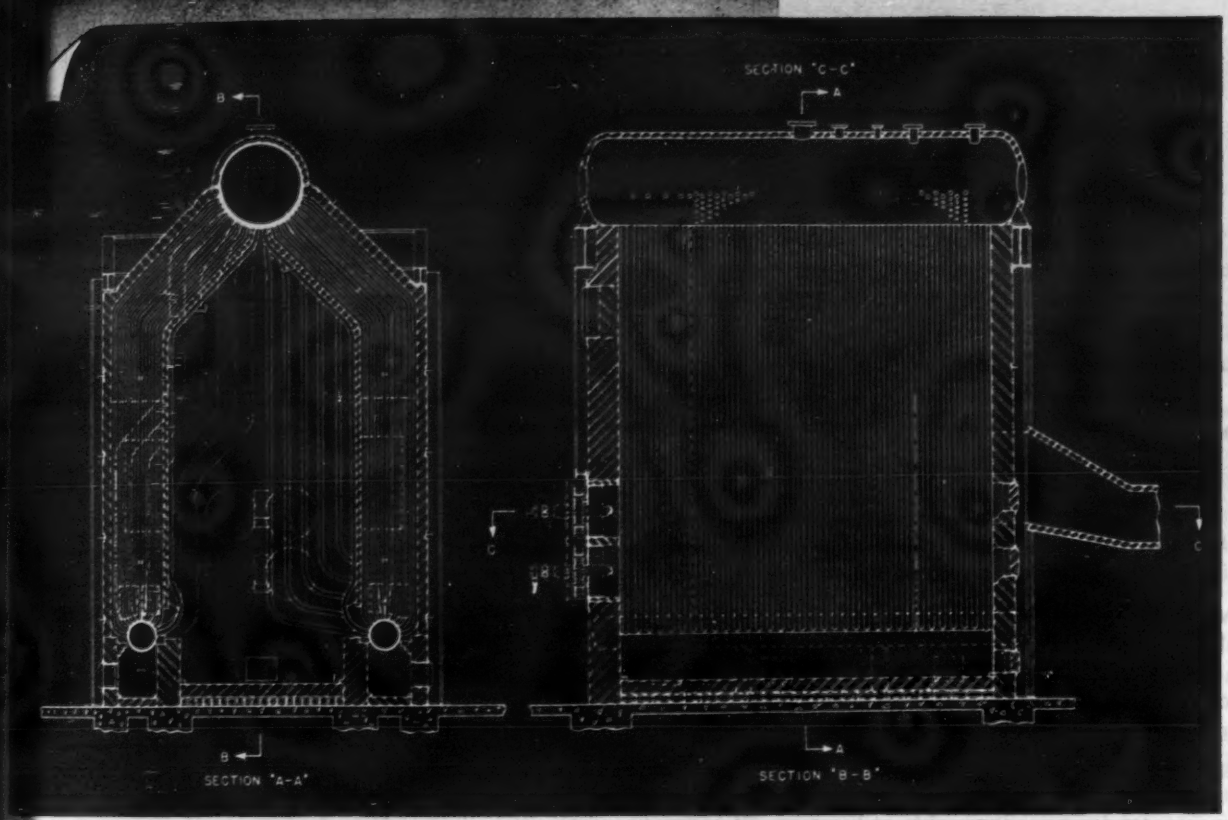
- Low Draft Loss
- Complete Combustion due to Long Flame Travel
- Sufficient Cooling of Gases to Prevent Slagging
- High Average Efficiency
- Wide Range of Superheat Control

Performance tells the story... there was no question as to what boiler to install when increased steam demands made additional steam capacity necessary.

FOSTER WHEELER CORPORATION
165 BROADWAY · NEW YORK 6, N. Y.

FW FOSTER

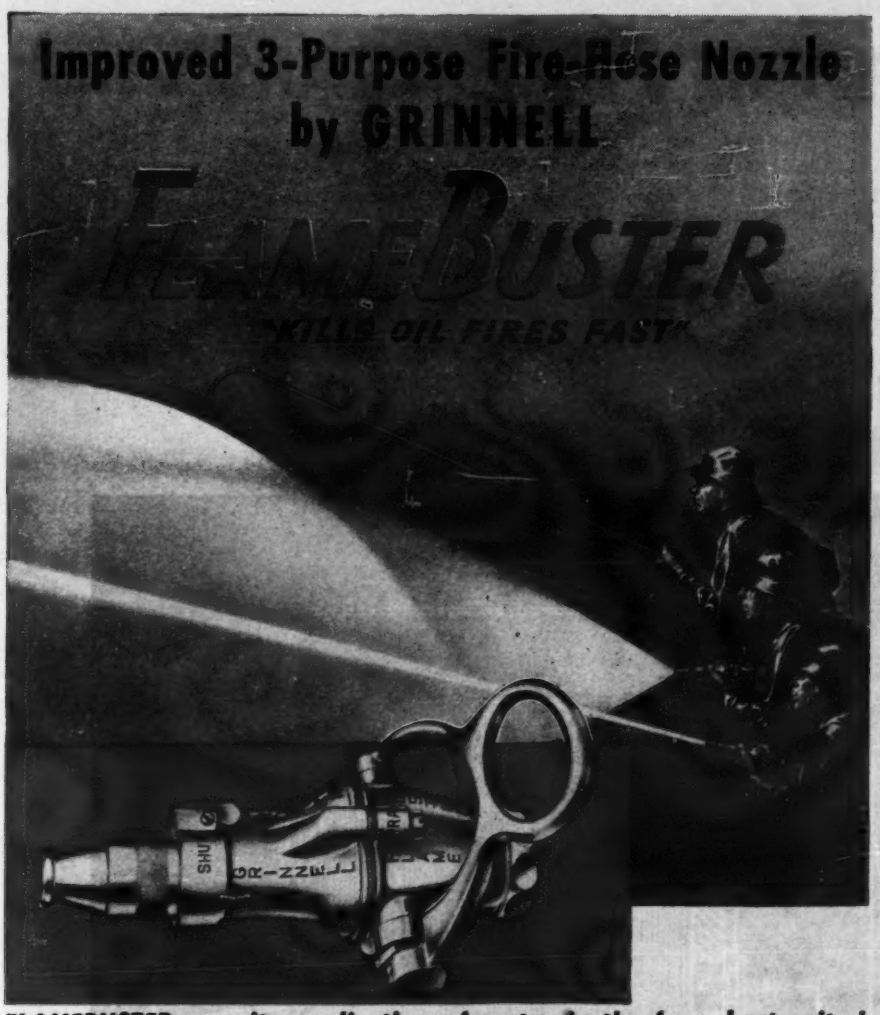
OIL REFINERY IN *FIVE* YEARS



Refinery Installation For a Prominent Oil Company

	Present Operation	*Contemplated Future Operation*
Number of Units	5	9
Steam Capacity	70,000 lb. per hr.	70,000 lb. per hr.
Design Pressure	645 lb. per sq. in.	645 lb. per sq. in.
Pressure: Superheater Outlet	250 lb. per sq. in.	600 lb. per sq. in.
Final Steam Temperature	(Saturated)	750 degrees F.
Feedwater Temperature	225 degrees F.	300 degrees F.
Fuel	Refinery Gas	Refinery Gas
Efficiency	79.1 per cent	83.0 per cent (with air heater)

WHEELER



FLAMEBUSTER permits application of water in the form best suited for quick control, according to the nature of the fire —

1. **Low Velocity Spray** . . . for extinguishing stubborn fires in light, flammable liquids. Projected at a wide angle by the unique Grinnell spray tip on a 4′ or 10′ applicator. The spreading cone of evenly distributed, fine spray, applied directly over blaze, puts out flames quickly, with minimum water consumption.
2. **High Velocity Spray** . . . for general fire fighting and for extinguishing fires in heavier oils by emulsifying the blazing oil with a driving spray of water, rendering it incapable of burning. Protects fireman approaching blaze.
3. **Solid Stream** . . . for rooting out deep seated fires and for projecting a volume of water a considerable distance. For fighting fires in electrical apparatus, a long-range, non-conducting spray is substituted for the solid stream.

FLAMEBUSTER'S single large orifice in high velocity tips and scroll design in low velocity tip prevent clogging. Easy disassembly simplifies maintenance. Grinnell Company, Inc., Executive Offices, Providence 1, R. I. Branch offices in principal cities.

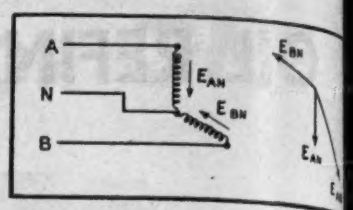


FIG. 1—Three-wire "network" or ope Y with its voltage vectors

sumption of balanced load and ma power factor while using a two-e ment meter.

Referring to Fig. 2

$$E_{AB} = E_{AN} - E_{BN}$$

The voltage E_{AB} has a magnitude $\sqrt{3}$ times the phase voltage a leads the voltage E_{AN} by 30 deg.

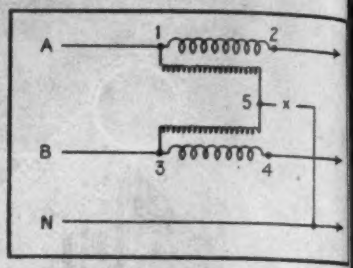


FIG. 2—Meter connections with neutr open at x

Current in Upper Element

$$I_{15} = I_{AN}$$

Current in Lower Element

$$I_{35} = I_{BN}$$

The two potential coils are in seri across E_{AB} and therefore the voltag across each coil is numerically $\frac{E_{AB}}{2}$

Upper Element, $E_{15} = \frac{E_{AB}}{2}$ in phase with I_{15}

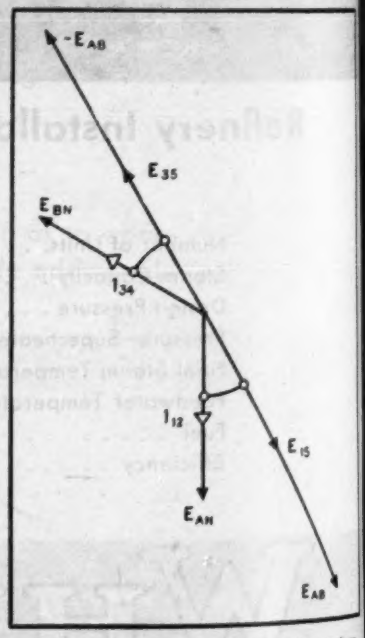


FIG. 3—Voltage and current vectors facilitate solution

INTRICATE LOW PRESSURE MOLDING

a deep contour mold

21 *inserts—with* MEGATHERM*

Here again Megatherm high-speed through-heating of plastic preforms provided the solution to a knotty production problem.

Ordinary methods of preform heating . . . plus mold closing pressures up to 120 tons . . . resulted in high rejection ratios in this part because of its irregular wall-thickness, deep-draw, and 21 metal inserts.

Free-flow conditions produced in the mold by Megatherm uniform heating reduced rejects to a minimum . . . producing parts with a high gloss finish free from flash . . . and the metal inserts were clean and bright.

At the same time . . . closing pressure was reduced to *37 tons.*

More and more alert molders are recognizing MEGATHERM as indispensable to high-speed quantity production of normally difficult and costly parts on a sound commercial basis.

When MEGATHERM *goes in . . . production volume goes up . . . and stays up!*

Write now . . . on your company letterhead for complete data on MEGATHERM engineered dielectric heat.

FEDERAL TELEPHONE & RADIO — FTR

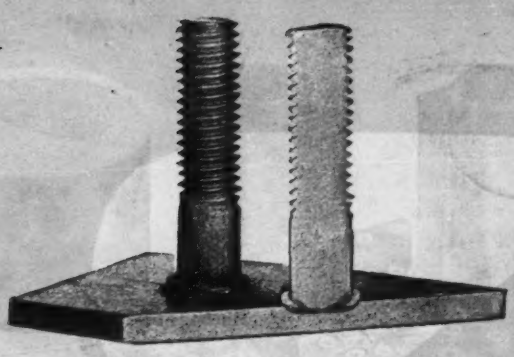
Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

Newark 1, N. J.

*Reg. U. S. Pat. Off.

Nelson Stud Welding eliminates stud drilling and tapping!



Cutaway view of end-welded stud shows how stud is completely fused with metal in ½ second.

Photographs by courtesy of Herbert H. Davis Co., Cicero, Ill.

Welding studs through template produces accurate duplication of parts. Studs are welded through guiding template to work underneath. The operator loads a stud into the gun chuck, inserts it into the hole and pulls the trigger. Welds are *automatically* made in an instant.

The Nelson Arc Stud Welder saves time and material because it secures studs without drilling and tapping holes. The manufacturing of air-conditioning equipment and industrial furnaces at the H. H. Davis Co. is a fine example of a typical industrial application.

The welds made with Nelson studs result in uniform work with *complete fusion* between stud and metal. Thousands are now being used by more than 650 industrial plants and shipyards. Operators can average 500 to 1000 stud welds in eight hours.

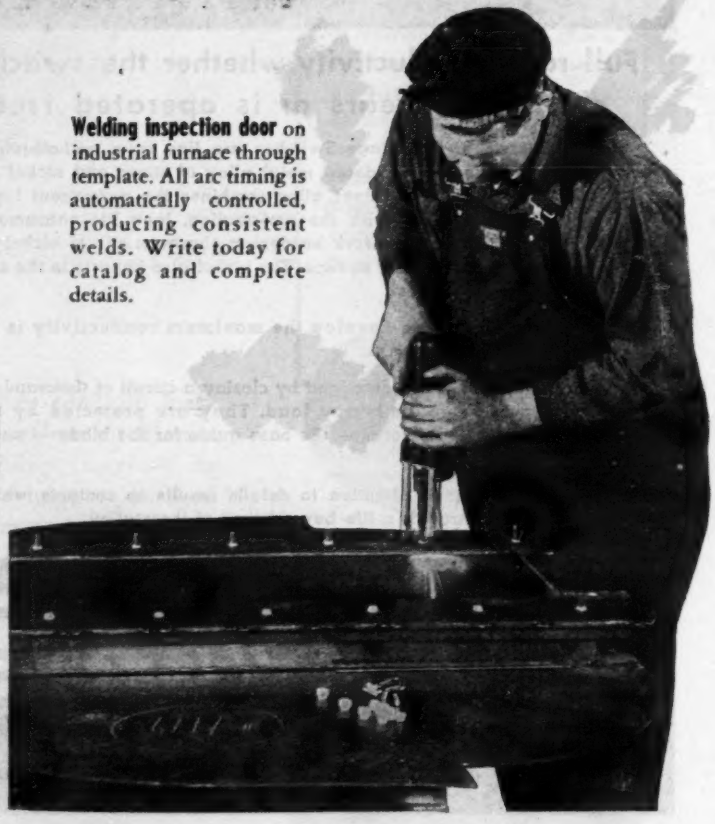
Nelson Stud Welders are fully automatic and are completely portable . . . they may be operated as a production unit or as a portable hand tool.

A template is used in welding studs to parts. Studs are welded through holes onto casing, insuring accuracy of spacing. Nelson Production Stud Welding Units, welders mounted on pneumatic cylinders and arbors, are also used where continuous production of parts is required.

Inspection plates of all kinds are welded in any position with the portable Nelson welder. Light in weight and easy to handle, it may be used efficiently in any location. Welds produced are as strong as any hand-welding method—have consistent weld fillets.

Welding inspection covers of all types is an ideal stud application. Studs are welded at desired centers to cover flange and cover secured with nuts. No holes in casing . . . close tolerances held.

Welding inspection door on industrial furnace through template. All arc timing is automatically controlled, producing consistent welds. Write today for catalog and complete details.



For catalog and prices write to

NELSON SPECIALTY WELDING EQUIPMENT CORP.

Dept. EW, 440 Peralta Ave., San Leandro, Calif.

Eastern Representative: Camden Stud Welding Corp. Dept. 122, 1416 So. Sixth St., Camden, N. J.

Full rated conductivity whether the switch remains closed for years or is operated frequently

The contacts of Hi-Voltage Switches are line type, self-aligning and self-cleaning. A ductile powdered metal alloy of silver and nickel is brazed to the copper parts. The silver alloy combines the permanent low resistance contact of fine silver with the non-gauling, long life characteristic of the silver-nickel alloy. The work hardening characteristic of nickel in the alloy produces a hard contact surface. The nickel also imparts to the contact material a lubrication effect.

Positive pressure to develop the maximum conductivity is maintained by stainless steel springs.

The contact cannot be damaged by closing a circuit of thousands of amperes or in opening under heavy load. They are protected by three auxiliary contacts — the horns — the base guide for the blade — and the bronze sleet hood.

In short Hi-Voltage attention to details results in contacts which maintain conductivity—through a life beyond that of the station.

HI-VOLTAGE
EQUIPMENT COMPANY
2891 East 79th Street • Cleveland 4, Ohio

(The path 15 is traced in the same direction as the path *AB*.)

Lower Element, E_{15} =

$$\frac{E_{AB}}{2} \text{ in phase with } -E_{AB}$$

(The path 35 is traced in a direction negative with respect to path *AB*.)

Torques

Let E represent the phase voltage and I the phase current at balanced load.

Upper Element, P_U =

$$\frac{\sqrt{3}}{2} EI \cos 30° = \frac{3}{4} EI$$

Lower Element, P_L =

$$\frac{\sqrt{3}}{2} EI \cos 30° = \frac{3}{4} EI$$

Total of both torques $P = \frac{3}{2} EI$

But with the correct connections, each potential voltage would be E in phase with I. Therefore, when correct,

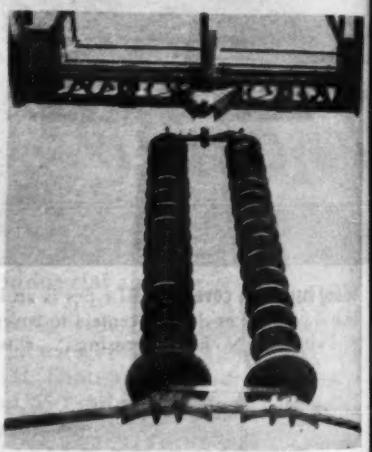
$$P = 2\,EI$$

and the ratio of registration is $(3/2\,EI)/2EI = 75$ percent.

•

River Crossing Span Design

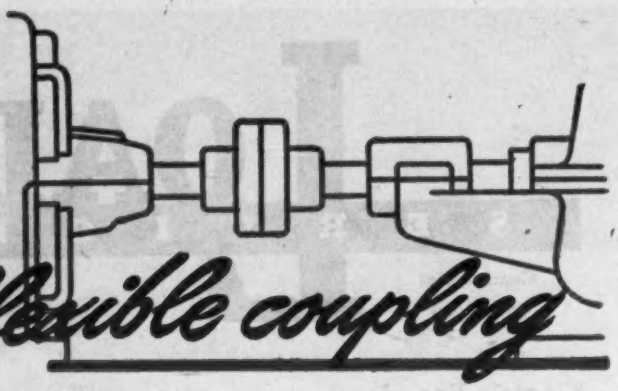
Suspension insulator supports of the type shown are used by Pacific Gas & Electric Co. for supporting 230-kv. conductors in a 4,135-ft. span over the Sacramento River. Ultimate



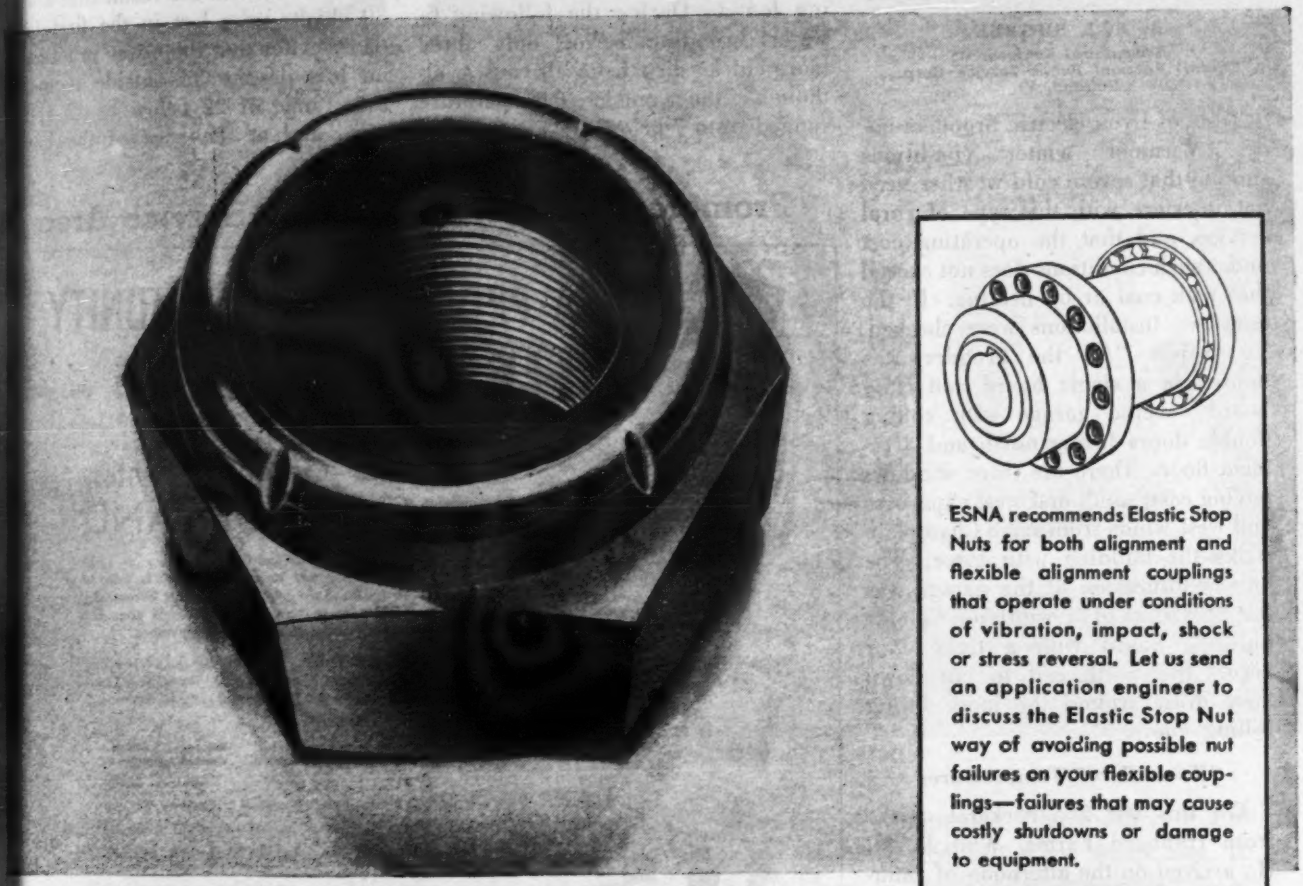
ASSEMBLY of double string of OB high-strength units for 4,135-ft. river crossing

strength of the assembly is 40,000 lb. or about two and one-half times the tension that would be imposed by the 790,000 ACSR conductor with a broken wire in the adjacent dead-end span. The 459-ft. tower on which this suspension is located was designed to withstand twice the load of six broken conductors in the adjacent deadend span.

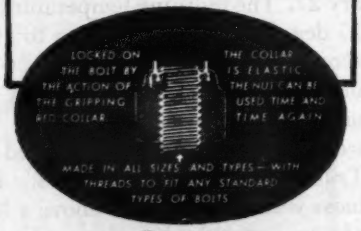
IT'S THE NATURAL THING



— for a flexible coupling



ESNA recommends Elastic Stop Nuts for both alignment and flexible alignment couplings that operate under conditions of vibration, impact, shock or stress reversal. Let us send an application engineer to discuss the Elastic Stop Nut way of avoiding possible nut failures on your flexible couplings—failures that may cause costly shutdowns or damage to equipment.


LOCKED ON THE BOLT BY THE ACTION OF THE GRIPPING ELASTIC COLLAR
THE COLLAR IS ELASTIC THE NUT CAN BE USED TIME AND TIME AGAIN
MADE IN ALL SIZES AND TYPES—WITH THREADS TO FIT ANY STANDARD TYPES OF BOLTS

ESNA
TRADE MARK OF
ELASTIC STOP NUT CORPORATION OF AMERICA
Union, New Jersey
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Sales Office—1060 Broad St., Newark 2, N.J.

ELASTIC STOP NUTS
Lock Fast to Make Things Last

The Elastic Stop Nut uses its head. It has what it takes to stay put in a coupling, no matter how tough the operating conditions.

Built into the head of every Elastic Stop Nut is a locking device — an elastic compression collar.

This collar forms itself to the individual bolt thread, grips it tight. The nut won't loosen up or back off under conditions of severe vibration, shock or impact.

When you use Elastic Stop Nuts you need no cotter pins, no lockwashers or any other auxiliaries with their attendant increase in assembly and servicing costs. And you can turn them up to the torque you need and be sure they will stay there. No backing up or straining to find a cotter-pin hole. They can be used over and over again yet still lock. You can use them on any standard bolt.

Here is sure insurance against loose nuts which will result in reduced coupling maintenance costs.

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Electric Brooders Serve in Winter

By R. J. BUGBEE,
Agricultural Engineer
Central Vermont Public Service Corp.,
Rutland, Vt.

Tests of Lyon electric brooders under Vermont winter conditions showed that severe cold weather need not interfere with this type of rural service, and that the operating cost under such conditions does not exceed that with coal or oil heating. In the tests two installations were checked. In project "A" the brooder was housed in a single board and clapboard covered garage with rolling double doors facing north and a cement floor. There are three windows having east, south and west exposures and west winds from Lake Champlain strike the building with force. The only modification of the garage was the provision of a width of Celotex building board with a tight door across the north end to cut down floor draft around the loose fitting rolling doors.

"Below Zero" Temperatures

For this test 255 cockerel chicks from Hubbard Farms, Walpole, N. H., arrived on the afternoon of January 27. The morning temperature was 27 deg. F. below zero, rising to about zero by afternoon. A Lyon 67-in. brooder with a ventilating fan was used, and two 3-gal. vacuum type water fountains were warmed by Trumbull automatic heaters. Peat moss was used for litter above a layer of newspapers directly under the brooder area. A wire guard covered with grain sacks, 18 in. from the hover edge, completed the equipment, except for small feeders placed radially with two-thirds of their length under the hover. Some feed was also placed on newspapers both under and outside the hover. During the first day seven chicks were caught outside on a sloping newspaper and could not climb back to the heat. These were chilled beyond hope before being found. During the following 6-weeks brooding period only three more chicks died from all causes, although the outside temperature ranged from 7 below to 41 above and from 19 to 54 deg. above zero at the floor level within the building.

In project "B" a 56-in. Lyon brooder was used. This was installed in a 10-ft. by 12-ft. standard brooder house located in one of the highest villages in the state. Hall Bros., Wallingford, Conn., donated 265 mixed red chicks which arrived on January 12. Records were kept for six weeks. The caretaker had never operated a brooder before, and through oversight no feed was put under the hover at the start, with the result that about 30 chicks were lost in the first four days. After that there was practically no loss despite an outside temperature range of 22 below to 42 above zero, and at the edge of the hover

Promotes Vacation Business in Service Area

A PROGRESSIVE COMMUNITY
HELPS ITSELF - -
Ulster-Greene Counties
VACATIONLAND
Located in Ulster and Greene Counties are 1,948 hotels, boarding and tourist houses with facilities to accommodate 78,286 guests. To a large extent, the prosperity of the community depends upon the popularity of the area as a vacation resort.
In 1941, community leaders began an advertising program to bring more visitors to Ulster-Greene Counties Vacationland. The following table shows how well they have succeeded!
1941 200 $5,000
1942 $1,000 32,500 1,000 $25,000
1943 $3,500 80,500 15,000 $300,000
1944 $3,900 147,500 24,000 $560,000
$8,400 260,500 40,200 $890,000
*These figures do not include expenditures for transportation, shopping and recreational facilities.
This company has been glad to help in this community enterprise. It congratulates the forward-looking citizens of Ulster and Greene Counties for the work they have already done and, in their progressive spirit, sees great promise for the future.
CENTRAL HUDSON GAS & ELECTRIC CORPORATION

ONE WAY FOR HELPFUL IDENTIFICATION of the utility with the interests of the territory it serves is illustrated by this advertisement published in major display size in local newspapers by the Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y., to assist in getting vacation business off to an early start

With a Westinghouse Full Line Franchise you always hold a winning hand!

Such a grand run of "picture cards" doesn't just "happen"! Into it has gone years of market study, home economics research, plus the experience gained in building 30 million pre-war electric home appliances.

Retailers with a Westinghouse Full Line Franchise have a partner that backs them up all the way. Millions of national advertising messages as well as strong local promotions all focus on one well-known brand name. And the fine performance of one product helping to sell another —means greater dollar sales per customer.

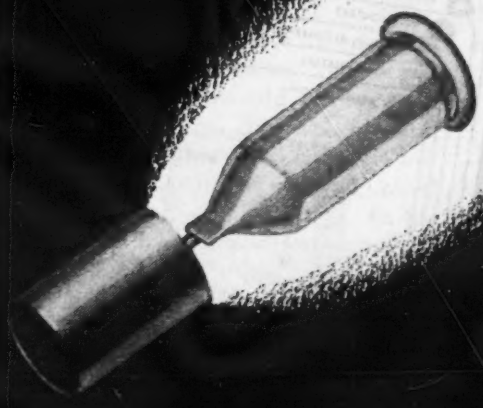
Ask your Westinghouse Distributor for the complete story of the Full Line Franchise. It shows you how to eliminate the "gamble" from your postwar appliance selling.

WESTINGHOUSE ELECTRIC & MFG. CO.
Plants in 25 Cities... Offices Everywhere
APPLIANCE DIVISION • MANSFIELD, OHIO

30 MILLION PRE-WAR
Westinghouse
ELECTRIC HOME APPLIANCES
YOUR PROMISE OF STILL FINER ONES TO COME

TUNE IN JOHN CHARLES THOMAS, SUNDAY, 2:30 EWT., NBC. • HEAR TED MALONE, MON. TUES. WED. EVENINGS, BLUE NETWORK

COLD CATHODE



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LIGHTING DIVISION

FEDERAL ELECTRIC

8700 S. STATE STREET, CHICAGO 19, ILL.
TELEPHONE VINCENNES 5300

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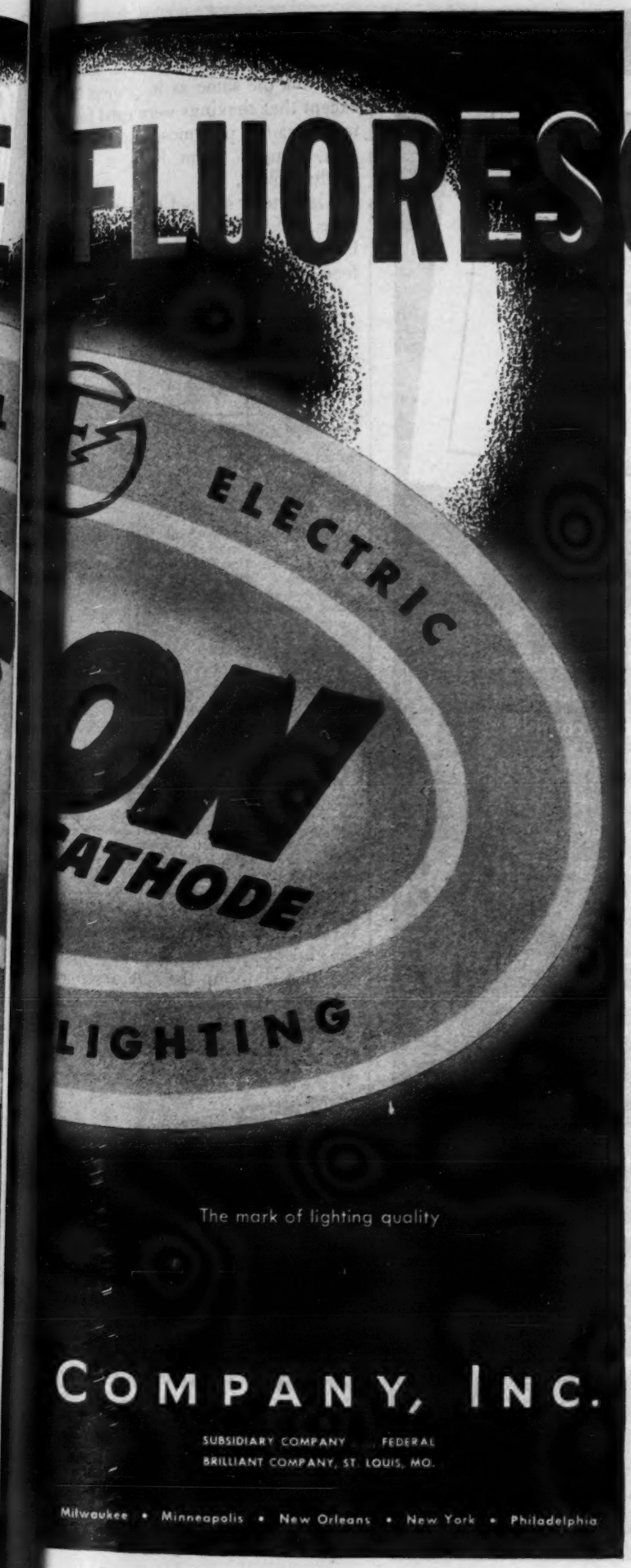


FLUORESCENT . . .

a definite answer to *Better* lighting!

Any modern system of fluorescent illumination means infinitely better lighting. But of the two recognized systems, Cold Cathode fluorescent is *best.* ZEON Cold Cathode is preferred because it means far longer lamp life, lower maintenance cost, instant starting, constant light flow, fewer auxiliaries and greater flexibility in shapes, sizes, colors, and output.

Federal Electric Company, Inc. has pioneered in the development and use of gaseous discharge lamps. In creating and perfecting ZEON Cold Cathode fluorescent lighting, Federal Electric found new and highly practical methods for its adaption to industrial, commercial, and decorative display illumination.

In planning for post-war installations, specify FEDERAL ZEON. You, your architect, or contractor are invited to submit your lighting problems in a detailed letter. Our engineers will be glad to give it thorough and immediate attention. Address Lighting Information Service, Federal Electric Company, Inc., 8700 South State Street, Chicago 19, Illinois.

Remember there are 2 kinds of fluorescent lighting!

"Hot Cathode" is the common heater filament type of fluorescent lamp; "Cold Cathode" is the improved shell-electrode type, of which Zeon is the outstanding example. Long life, lower maintenance cost, greater flexibility are some advantages of Zeon Cold Cathode fluorescent lighting.

A CHAMPION Engineering

Service at no cost to you as a user

of Industrial Lighting

CHAMPION

Champion Lamp Works, as one of the largest and longest established producers of fine quality *Fluorescent* and Incandescent Lamps for industrial use, offer a complete lighting service. Champion lighting engineers are prepared to furnish *enlightened* and impartial counsel on proper lighting for any and every industrial application. We have nothing to sell but lamps.

This is offered without charge, in the interests of better lighting and, thereby, a genuine contribution to production efficiency, safety, working morale and service on Champion Lamps.

Whatever your lighting problem, large or small, present or postwar, get in touch with us for competent lighting engineering counsel. There is no cost or obligation to you.

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

from 11 below to 52 above. The operation of the litter, guards, feeders, etc., was the same as in project "A" except that shavings were used for litter instead of peat moss and the water was brought warm from a nearby poultry plant.

These tests showed that it is necessary to have a specially constructed building for electric brooding; that feed must be provided under the hover

Electric Brooder Tests in Winter

Six Weeks' Run	Project "A"	Project "B"
Brooder used	67-in. Lyon with fan	56-in. Lyon with fan
No. of Chicks started	255	265
Chick Mortality	10	34*
Outside temp. range	7 below to 41 above 0	22 below to 42 above 0
Inside floor temp. range	19 above to 54 above 0	11 below to 52 above 0
Brooding dates	Jan. 27 to March 10	Jan. 12 to Feb. 2
Kw.-hr. used	473	295
Cost of electricity	$9.46	$5.90
Cost of electricity per Chick	3.89 cents	2.55 cents
Grain used per Chick, lb.	4.444	3.76
Grain cost per Chick	10.53 cents	8.776 cents
Cost for Grain and and Electricity*	$0.144	$0.113 cents
Weight per Chick, lb., at end	1.5	1.07

*Thirty chicks were lost through caretaker's unfamiliarity with feeding requirements in first four days. Only four were lost after this time, during the six weeks of brooding.

*The cost of grain has increased and that of electricity decreased, following this test. The ratio of electric cost to total grain and power cost is still more favorable to electricity at this writing.

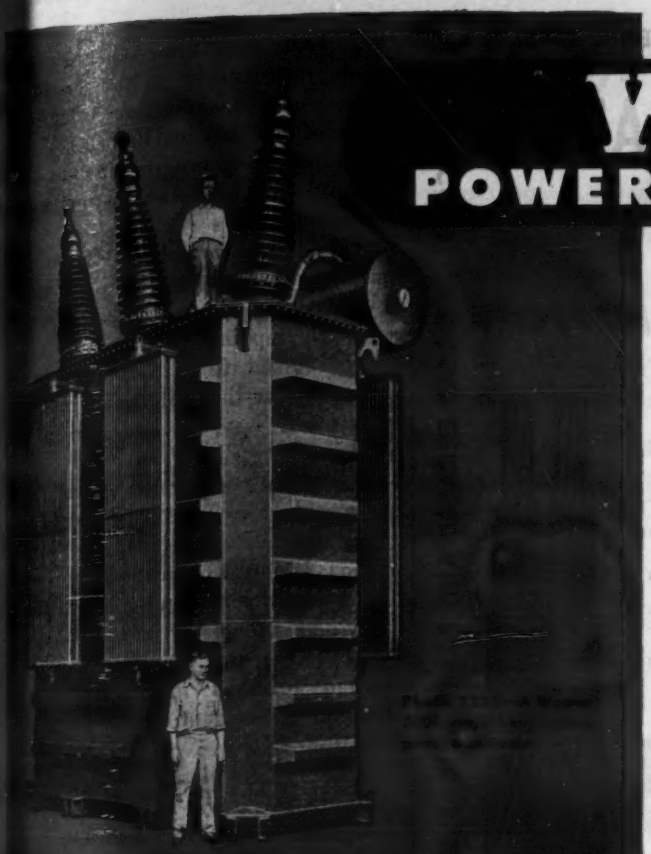
for the first few days; that overcrowding cuts down the energy consumption but also slows up the rate of growth, and that the labor element and fire hazard are reduced to a minimum with electric service.

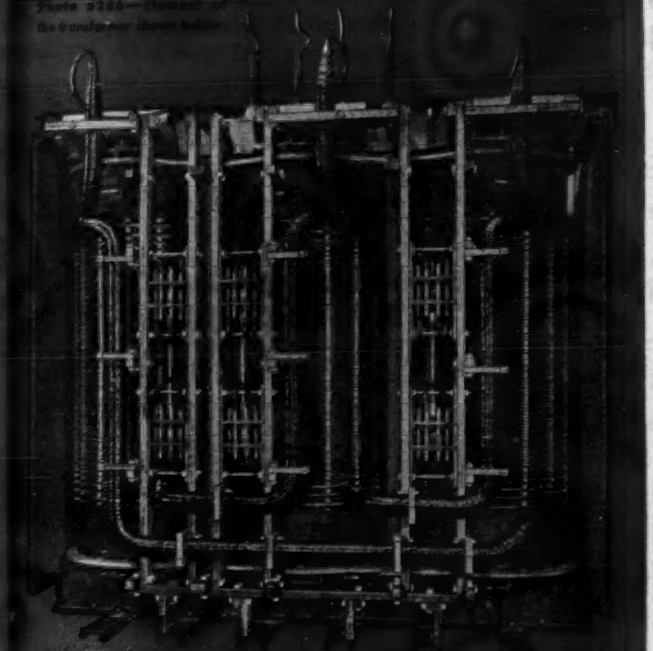
•

Survey Conversion Plans of War Sub-Contractors

Extent to which industrial firms engaged in war sub-contracting work in the Wichita area are preparing in advance for the post-war transition to civilian production is reflected in the replies of 66 concerns to a survey conducted by the industrial sales department of Kansas Gas & Electric Co. in cooperation with the post-war planning committee of the Wichita Chamber of Commerce.

1. To the question "Does this firm plan to continue business in the post-war period?" 61 firms answered "Yes"; 5 "No."





Wagner
POWER TRANSFORMERS

Give Unfailing Service...

Wagner power transformers are proving their ability to give unfailing service today as they have proved it for the past fifty years. This reliable service has been maintained throughout the years due to Wagner's policy of always utilizing the latest developments in transformer design, materials, and processes of manufacture, executed by skilled workmen (some of whom have been with the company for over forty years).

Every power transformer purchaser, of course, has specific needs which must be met. Therefore, each Wagner power transformer is built to meet these necessary predetermined considerations. Various parts and the methods of fabricating them are standardized, but their final assemblies vary as each individual customer's requirements dictate.

An *Extra* Margin of Safety to Withstand Electrical and Mechanical Stresses Is Incorporated in Wagner Transformers.

The ten points of construction listed below are but a few of the many details that make Wagner Power Transformers reliable under all operating conditions. There are many others—for the complete story read Bulletin TU-181 on Wagner Power Transformers. A copy will gladly be sent you, without obligations on your part.

1. COILS are carefully insulated with cable-paper insulation, the insulation thickness varying with the voltage class of the transformers. The coils adjacent to the line terminals (buffer coils) have much heavier turn insulation than the mail winding and are in addition heavily taped with varnished muslin over the paper insulated conductors. **2.** INSULATION between windings and between windings and core consists of mechanically and electrically strong insulating cylinders. Barriers of pressboard insulation are used between coil stacks on different legs between the coils and the yoke iron, and when necessary between disk coils of the same winding. **3.** LEADS—outgoing and taps—are heavily insulated and rigidly supported. **4.** TAPS are generally brought out in the center of the coil stack. Tap leads may be brought out to a tap changer (as shown) or to a tap terminal board, depending upon specific requirements. Each individual tap is made at the outside cross-over connection between coils. **5.** BOLTED CORE CONSTRUCTION is used in order to clamp the leg laminations together so as to form a rigid structure. It has the added advantage of minimizing noise. **6.** ENDPLATES, of heavy structural steel, are used to clamp the yoke laminations, thus forming a rigid core construction. **7.** COIL CLAMPS, supported by the endplates, are adjustable axially so as to insure positive bracing of the coil stacks against axial motion under short circuit. **8.** CORE SUPPORTS and the extended endplates definitely locate the element in the tank, preventing shifting, and facilitate handling of element when removed from the tank. **9.** TANK is mechanically strong, of heavy copper-bearing sheet-steel, welded into one integral unit. **10.** BUSHINGS are thoroughly modern and designed specifically for transformer use.

TRANSFORMERS
are but one of several WAGNER PRODUCTS serving industry.
Other WAGNER PRODUCTS:
AIR BRAKES
•
HYDRAULIC BRAKES
•
BRAKE LINING
•
INDUSTRIAL BRAKES
•
INDUSTRIAL BRAKE CONTROLS
•
NoRoL
•
TACHOGRAPH
•
ELECTRIC MOTORS

ARMY E NAVY

Wagner Electric Corporation
ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

Our 29 Branches are manned by trained field engineers who are ready to help you solve your transformer problems—there is a branch near you.

• RUBBER POWER CABLES • VARNISHED CAMBRIC CABLES •

CRESCENT SERVICE CABLES

Employ

Heat Resisting Insulation

● *ALL* CRESCENT Service Cable is insulated with a Type RH, super-aging, heat resisting rubber compound of the best grade obtainable that gives 35% to *44% greater current carrying capacity* than ordinary code grade insulated service cable.*

● Service cable is the bottleneck limiting the amount of customer demand for all appliances, and future business for the contractors, dealers, wholesalers and power suppliers.

● With CRESCENT SERVICE CABLE you get maximum load capacity, long life and value. Made in Type SE, Style U, as shown; Style A with a galvanized steel armor tape over the bare neutral conductor, and in Type SD, Drop Cable. Sizes —#12 to #2 AWG in two and three conductors.

*Based on 1940 N. E. Code

Available Through Electrical Wholesalers

• BUILDING WIRE • SERVICE ENTRANCE CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE • ARMORED CABLE •

• PERMACORD • LEAD-ENCASED AND PARKWAY CABLES • SYNTHOL WIRES • WELDING CABLES • SHIPBOARD CABLES •

CRESCENT WIRE & CABLE

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N J

• IMPERIAL NEOPRENE JACKETED PORTABLE CABLES •

2. Forty-three firms said they had made decisions as to the products they would manufacture after the war; 18 said they had not.

3. Regarding progress in post-war planning the following answers were obtained:

(a) A post-war planning committee or individual has been designated by 40 organizations but 20 had made no such appointments.

(b) Asked if development of products, such as the building of models, was under way, 25 said "Yes"; 20 "No."

(c) Plant conversion plans had been started by 28; 32 had started no plans.

(d) Progress on post-war financial needs was reported by 42 but 19 said they had made no progress.

(e) Regarding accounting, 38 reported progress in setting up a method of accounting; 22 reported no progress.

(f) On sales plans for the post-war period, 28 stated they had made progress; 32 said they had not.

4. Of 61 firms only 8 said that they could use hired consultants or specialists and would be willing to pay for their services; while 53 said they could not.

5. To the question of which types of consultants they would use, 5 said "sales," four said "all" and one said "finance."

6. Regarding their possible use of Chamber of Commerce advisory committees, 13 stated they would make use of such committees and 48 said "No." Affirmative answers were divided among committee types as follows:

(a) Finance—3, (b) Accounting—2, (c) Product engineering—5, (d) Sales management—12, (e) Advertising—11, (f) Other—1.

•

Uncommon Uses for H. F. Heating—III*

By E. D. TILLSON
Testing Engineer
Commonwealth Edison Co., Chicago, Ill.

From among 200 materials and parts brought to the Commonwealth Edison Co. laboratories by industrial customers for experimentation in the use of high frequency induction and

* Based on paper presented by the author before "High Frequency Heating Conference" sponsored by Great Lakes Power Club and Chicago Lighting Institute.

A NEW STANDARD FOR HEAVY-DUTY TRUCKS

The Army called for the roughest, toughest truck that could be built, designed to *begin* its job where most other trucks stop.

Ward LaFrance has been producing this super truck in volume for Army ordnance. Out of it has come an entirely new standard of heavy-duty truck reliability and performance. Ward LaFrance has been building good trucks for a quarter of a century, but frankly, never any that could compare with these new commercial models inspired by the design and performance of the Army M1A1 Heavy Wrecker. They are *big* trucks with pay load capacity ranging up to thirty tons. They are built to take a beating and still stay on the job. They are designed, engineered, and manufactured to establish new standards in low-cost hauling. Before you invest, investigate Ward LaFrance.

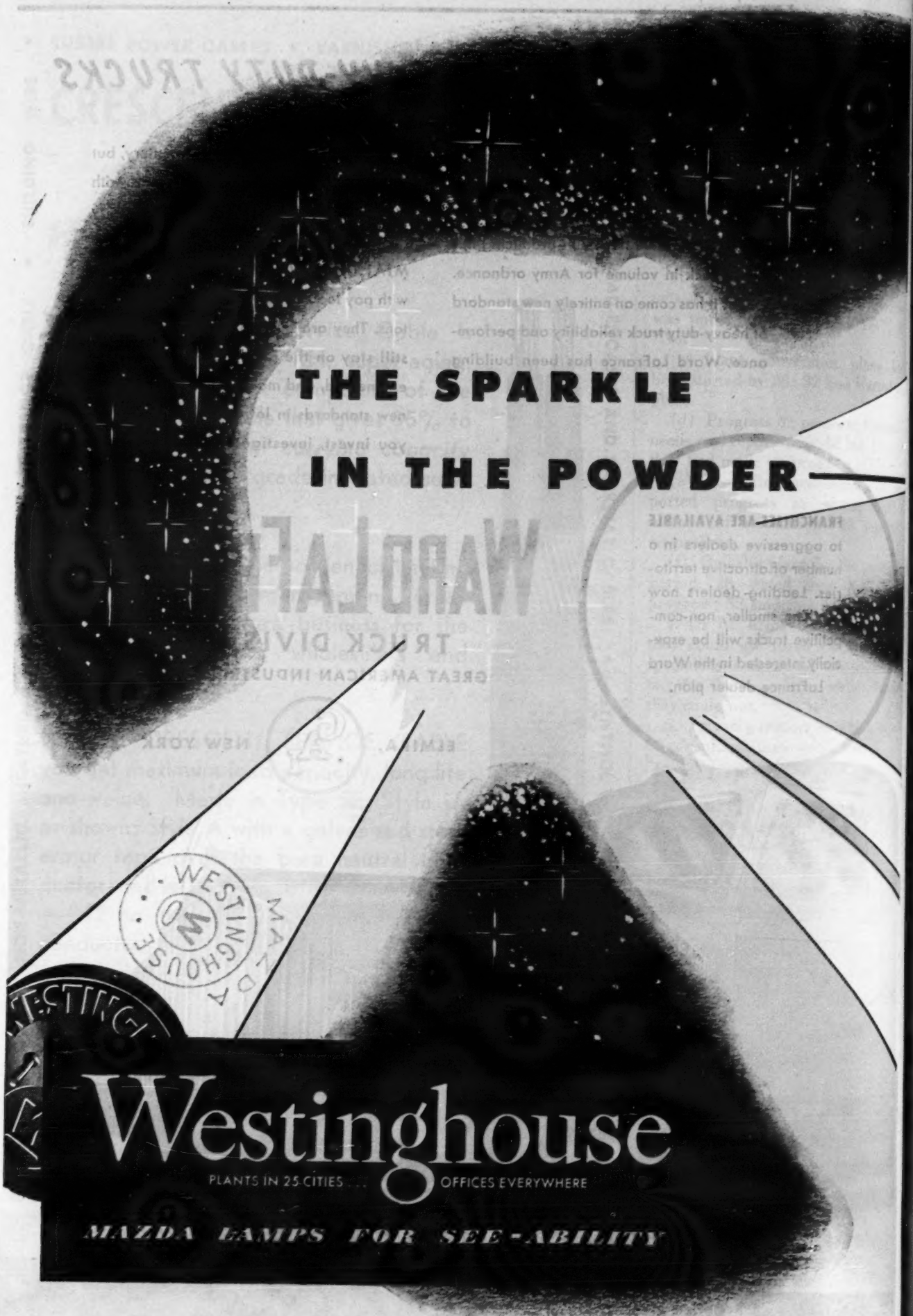
FRANCHISES ARE AVAILABLE to aggressive dealers in a number of attractive territories. Leading dealers now handling smaller, non-competitive trucks will be especially interested in the Ward LaFrance dealer plan.

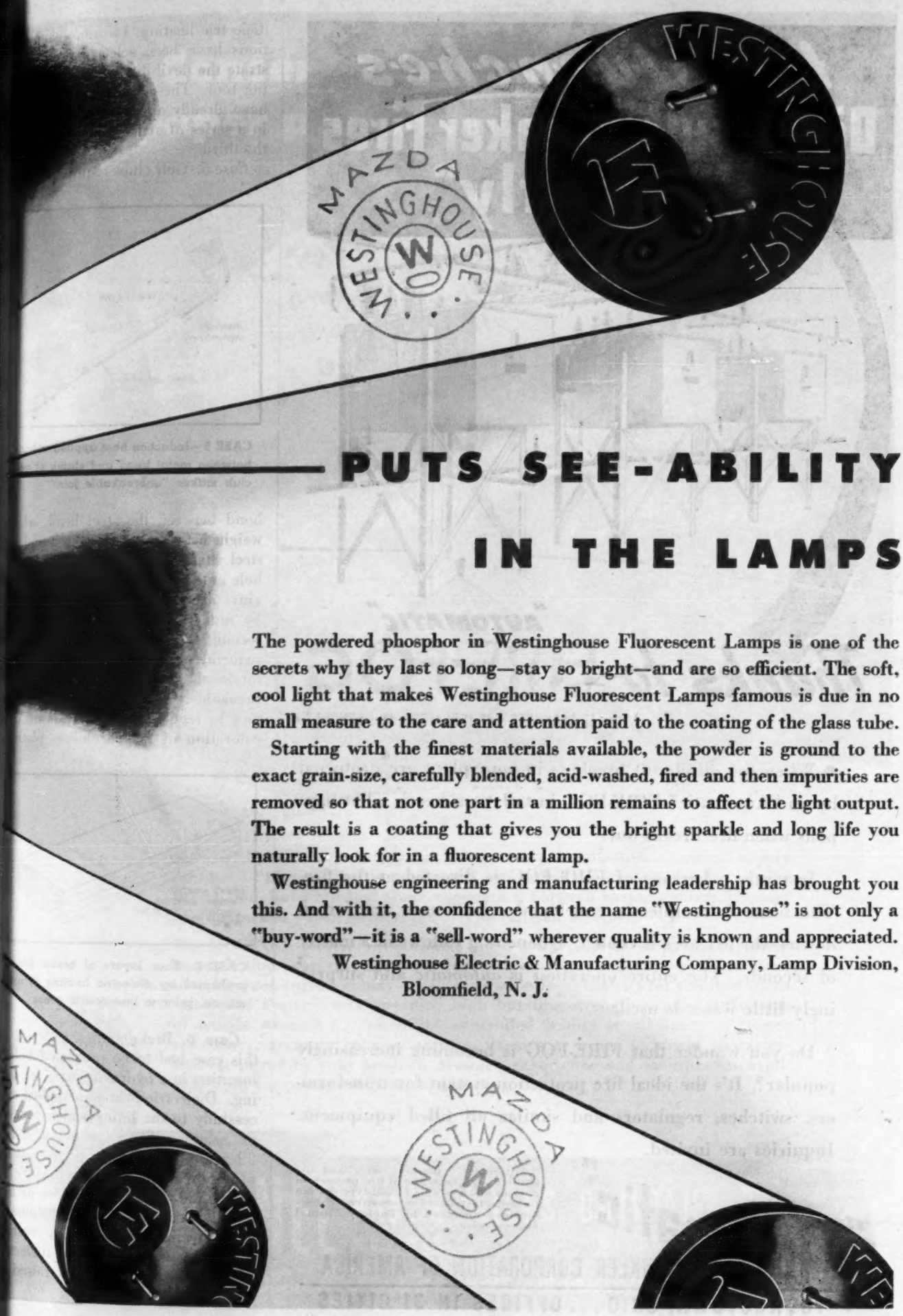
WARD LAFRANCE

TRUCK DIVISION

GREAT AMERICAN INDUSTRIES, INC.

ELMIRA, NEW YORK


THE SPARKLE
IN THE POWDER
WESTINGHOUSE
MAZDA
Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE
MAZDA LAMPS FOR SEE-ABILITY



PUTS SEE-ABILITY IN THE LAMPS

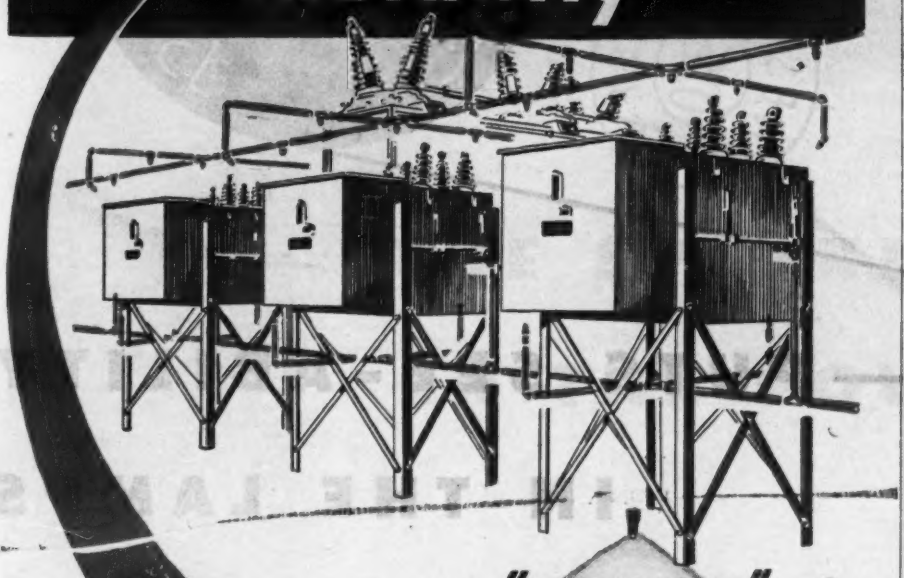
The powdered phosphor in Westinghouse Fluorescent Lamps is one of the secrets why they last so long—stay so bright—and are so efficient. The soft, cool light that makes Westinghouse Fluorescent Lamps famous is due in no small measure to the care and attention paid to the coating of the glass tube.

Starting with the finest materials available, the powder is ground to the exact grain-size, carefully blended, acid-washed, fired and then impurities are removed so that not one part in a million remains to affect the light output. The result is a coating that gives you the bright sparkle and long life you naturally look for in a fluorescent lamp.

Westinghouse engineering and manufacturing leadership has brought you this. And with it, the confidence that the name "Westinghouse" is not only a "buy-word"—it is a "sell-word" wherever quality is known and appreciated.

Westinghouse Electric & Manufacturing Company, Lamp Division,
Bloomfield, N. J.

H_2O Quenches Oil Circuit Breaker Fires "Instantly"



"AUTOMATIC"

Thanks to FIRE-FOG

★ IT BLANKETS ★ IT ISOLATES ★ IT QUENCHES ★

● When the oil circuit breakers in your plant are protected by an "Automatic" FIRE-FOG installation, here's what happens when fire breaks out:

Instantly a barrage of FIRE-FOG is directed at the fire. The blaze is completely enveloped—the flames are forced down—the fire area is cooled. Quenching follows in a matter of seconds. The entire operation is *automatic* and surprisingly little water is used.

Do you wonder that FIRE-FOG is becoming increasingly popular? It's the ideal fire protection system for transformers, switches, regulators and similar oil filled equipment. Inquiries are invited.

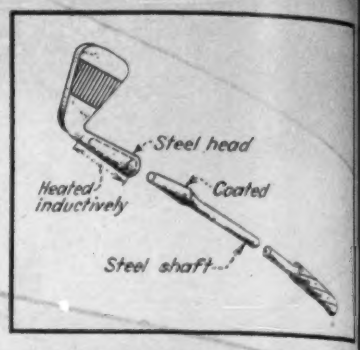
"Automatic" manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories—approved by Factory Mutual Laboratories.

"Automatic" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . OFFICES IN 31 CITIES

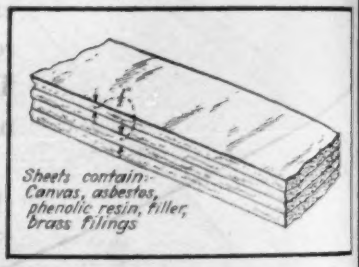
dielectric heating, 14 unique applica tions have been selected to demon strate the flexibility of this new hea ing tool. These cases, of which four have already appeared, are describe in a series of articles of which this i the third.

Case 5. Golf clubs require a strong



CASE 5—Induction heat applied to bond between metal head and shank of golf club makes "unbreakable joint"

bond between the steel head, which weighs between 8½ and 10 oz., and the steel shaft. In this case the tapered hole in the head was coated with polyvinyl acetate. The head was heated by induction to 350 deg. F. in one second. The resulting bond was subsequently subjected to a very severe torsional test and pronounced unbreakable. This binding method is now in regular use. There is no discoloration of the chromium plating.



CASE 6—Four layers of brake lining preheated by dielectric heating in one minute, prior to insertion in press

Case 6. Brake lining material in this case had to be preheated before insertion in a hydraulic press for curing. Dielectric heat was applied successfully to the lining which consists of asbestos fiber, penonolic resin, filler and brass filings. Because of the filings breakdowns occurred with only single and double thicknesses of material. This trouble was overcome as more layers were added. By treating four layers at once using dielectric heat, the temperature was raised to 500 deg. F. in one minute.

To Conserve Critical Materials this paper prescription was created:

MOSINEE, as a war material, has solved many manufacturers' critical supply problems. "Discoveries" in paper and processing, important also to postwar production, have resulted from cooperation between manufacturers, product engineers, and paper technicians of The Mills of Mosinee.

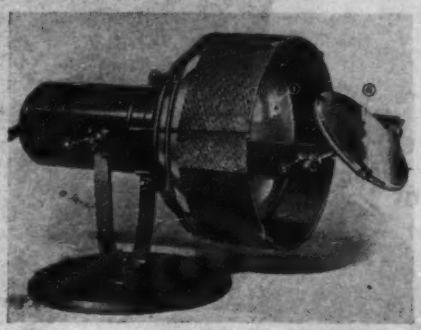
The MOSINEE presciption outlined above is a typical development, resulting in paper that is serving the war effort with complete satisfaction. Discussions with Mosinee engineers may disclose valuable opportunities for you in modern "Essential Papers" with specified high bursting strength . . . dielectric, tear or tensile strength . . . pliability, controlled acidity or alkalinity . . . water repellency, accurate caliper, uniform density or other technical characteristics required by your product. Mosinee experience and facilities are available now, for present or postwar planning.

Please address your letter "Attention Dept. B

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

NEW EQUIPMENT

Inspection Lamp

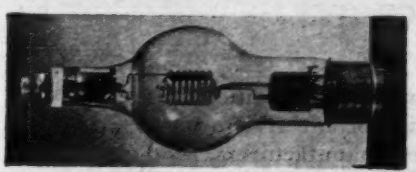


No. 7500 inside inspection lamp: 100 watt, 120 volt; 12-ft. cord; adjustable light and mirror. McGill Manufacturing Co., Inc., Valparaiso, Ind.

Lamp developed to facilitate inspection inside of castings, shells, tubes and other objects having a deep opening. The beams from the R-40 spotlight are directed into the cavity which makes inside of the article being inspected clearly visible in the adjustable mirror. Unit is said to make more complete inspection possible with less worker fatigue.

•

Rectifier Tube



No. TR-40M half-wave rectifier tube: filament power—5.0 v. at 10.5 amp.; peak forward voltage 25,000; peak inverse voltage 60,000; average plate current 0.25 amp. Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago, Ill.

Tube is equipped with a 4-pin jumbo (50-watt) base and the glass is Nonex. Filament is thoriated tungsten which is said to assure long life. Plate lead is at the top of the tube, and the filament leads are brought out to pins Nos. 2 and 4. Design is said to insure safety against voltage breakdowns.

•

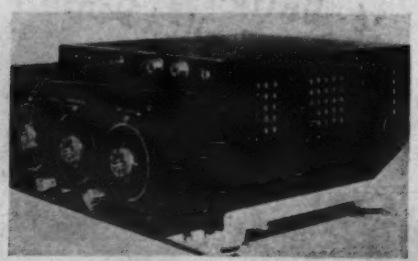
Ladder Tower

"Multi-Purpose" elevating ladder tower: 350 deg. turning radius; extended height 38 ft.; in horizontal position, folded, 17-ft. 1 in. long and 6-ft. 3-in. high; folding work platform 24 by 30 in.; adjustable tubular guard rail. Universal Fittings & Scaffolding Co., Zelienople, Pa.

Elevating ladder is made in three trussed sections—locked in place by continuous steel guides operating on sleeve-type bronze roller bearings. Maximum working height of 35 ft. 2 in. is obtained with ladder at a 75 deg. angle. Rigidity is said to be provided by a 4-ft. 8-in. overlap between top and middle section and a 5-ft. 10-in. overlap between middle and bottom section. Tower is reported as elevated and extended by single hand operated winch which is self-locking at any extended height.

•

Mobile Transmitter



Single crystal transmitter for mobile communication: three dial; eight channel; 100-156 megacycle band. Bendix Radio Division, Bendix Aviation Corp., Teterboro, N. J.

Eight channel, single crystal, mobile service transmitter which, it is reported, can be set for any frequency in the 100-156 megacycle band. Frequencies are said to be determined by dial calibration without the use of a crystal frequency indicator. It is stated that the unit can be used in any type of mobile equipment and can be converted from amplitude modulation to frequency modulation.

•

Fluorescent Units

Units for two and three 40-watt lamps: No. 1672-C, two lamp, unlouvered; No. 1673-C, three lamp, unlouvered; No. 1682-C, two lamp louvered; No. 1683-C, three lamp, louvered; dimensions, 48 in. long, 11¾ in. wide, and 7⅝ in. high to ballast top; steel wiring-channel and reflector; channel finish, gray; reflector finish, Fluracite white, both sides; ballast and starters top mounted; 110-124 volt or 220-250-volt. Curtis Lighting, Inc., 6135 W. 65th Street, Chicago 38, Ill.

Industrial unit is available with or without louvers. Units can be hung individually or in continuous lines by means of chain, conduit or cable. They may be wired for pull switch, if desired. Construction is said to be similar to No. 1626-C except that reflectors are narrower and deeper and are finished both inside and out with white Fluracite.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Test Sets

Two a.c. test sets: one, 0 to 3,000 volts and the other 0 to 6,000 volts; 115 volt, 50 or 60 cycle supply; cap. 2,000 volt—amp.; mounted on 3-wheel truck. General Electric Co., Schenectady 5, N. Y.

Both sets consist of a dry-type transformer, variable-voltage autotransformer, two indicating voltmeters, voltmeter selector switch, signal lamps, air circuit breaker with magnetic overload trip, and a supply switch. Two 15-ft. shielded test leads with insulated handles and a 15 ft. supply cord are included. One of the voltmeters is used up to half maximum rating, and the other up to full test voltage.

•

D.C. Power Supply

Model FTR-3128-S regulated voltage power supply: output 10 amp. at 22 to 30 volts; input 115 volts, 58 to 62 cycles, "on-off" switch; zero to 30 scale d.c. voltmeter; 8-ft. rubber-covered supply cord. Federal Telephone & Radio Corp., Newark, N. Y.

Unit utilizes a selenium rectifier and output voltage is said to be held between plus or minus 0.5 volts with load variations from zero to 10 amp. or supply voltage variations between 105 and 125 volts. Ripple voltage is said to be limited to approximately five per cent.

•

Welding Electrode

"Fleetweld 47" all position welding electrode: sizes, 5/32 by 14, 3/16 by 14, ¼ by 18 and 5/16 by 18 in. Lincoln Electric Co., Cleveland 1, Ohio

Electrode said to conform to American Welding Society electrode specification

UBBARD AUTOGAP FUSE CUTOUT

NO. 2315

HUBBARD AUTOGAP FUSE CUTOUT is a combination of No. 2302, 9 KV Autogap Lightning Arrester with a new, improved 7-1/2 KV open type fuse cutout. The assembly is Stock No. 2315.

VOLTAGE, phase to ground is recommended to be limited to 7500 Volts.

FUSE rating is 50 Amperes. Fuse links are not furnished. Any standard can be used.

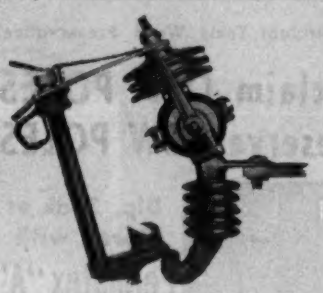
INTERRUPTING CAPACITY of the Hubbard Autogap Fuse Cutout is 1200 Amperes.

MOUNTING Brackets are available. No. 2323 for Crossarm and No. 2325 for pole. Specify type of mounting when ordering.

WEIGHT of the assembly is 18 Pounds each, packed for shipment.

HUBBARD AND COMPANY

PITTSBURGH · CHICAGO · OAKLAND, CALIF.



CLOSED POSITION: The flat, phosphor bronze spring at the top is in tension, ready to kick out the mechanism instantly when the blowing of the fuse releases the tension.

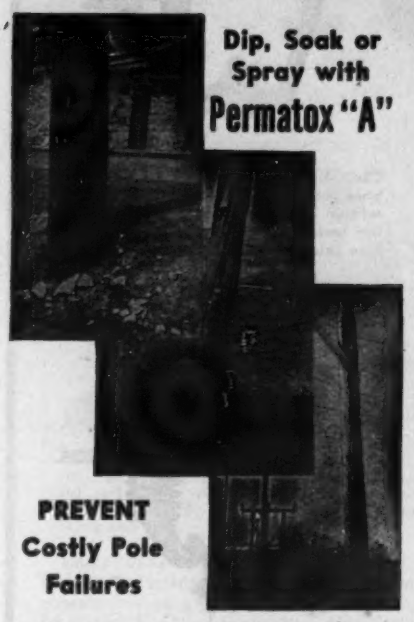
OPERATING: This view shows the action during transition from "closed" to "open" positions. The fuse has blown and the toggle mechanism is forced open by the top contact spring. The gap caused by the blown fuse is instantly lengthened to at least 3-inches by the leverage of the toggle mechanism, causing the arc to be extinguished within the fibre fuse tube rather than at the top contacts, where burning might occur.

OPEN POSITION: Top contact spring is relaxed, having exerted its pressure toward opening the mechanism. Tube drops to hanging, open position which places the notch for "hot-stick" removal of fuse tube in an accessible spot

PERMATOX "A"

(A Straight Toxic Wood Preservative)

Reclaim OLD POLES
Preserve NEW POLES



Dip, Soak or Spray with **Permatox "A"**

PREVENT Costly Pole Failures

With the pole shortage becoming more critical, it is vitally necessary to get the utmost service from every pole now in stock or installed on your lines.

PERMATOX "A" (5% pentachlorphenol in suitable petroleum solvents) affords an effective, economical preservative treatment . . for the control of decay, shell-rot and termite attack.

Specify it for poles, posts, crossarms, ties, crossing planks, bridge timbers and other exposed construction. Soaking or pressure treatment insure adequate absorptions and deep penetration.

Furnished in Two Forms:—

DOWICIDE 7
Pentachlorphenol* crystals

PERMATOX "A"
5% Pentachlorphenol* in suitable petroleum solvents
*Manufactured by The Dow Chemical Company

Write for Bulletin—Dept. E.

A. D. CHAPMAN & COMPANY, INC.

333 N. Michigan Ave., Dept. "E"
Chicago 1, Ill.
Atlanta Memphis Portland
New Orleans New York

class E-6012 and E-6013 and to be usable with either a.c. or d.c. Advantages reported are low spatter loss, easy slag removal and good re-striking characteristics. It is said to be well suited for making high speed horizontal or flat welds over 4-in. long in which the coating can be dragged on both plates, also for vertical and overhead fillets where large single pass fillets are needed.

•

Meter

Model 120 ohmmeter: 1½ in. size; ring mounted; waterproof. DeJur-Amsco Corp., Northern Blvd. & 45th St., Long Island City 1, N. Y.

Instrument is available in a wide variety or ranges including the sensitive microammeter and microvoltmeter specifications. It can be mounted on steel or Bakelite panels which are between $\frac{1}{16}$ and $\frac{1}{4}$ in thickness. Case including the terminal studs are reported as waterproof. It is said to remain waterproof if the glass breaks. Meter is stated to be constructed of corrosion resistant materials, to have black anodized finish and to conform to A.S.A. specifications.

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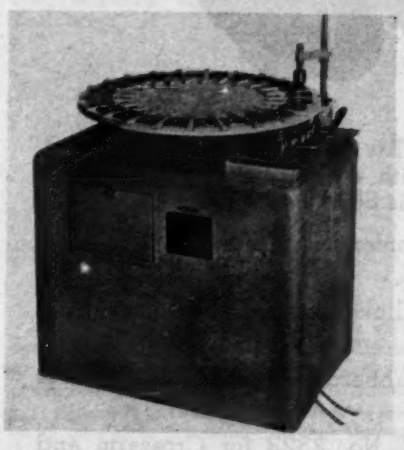
Brazing Equipment



Circular indexing carrier: 24 stations. Scientific Electric Division, "S" Corrugated Quenched Gap Co., 107-119 Monroe St., Garfield, N. J.

A 24-station circular indexing carrier mounted on a 18-kw. electronic high-frequency generator to braze metal assemblies. Complete assembly is said to be ejected in 12 seconds. Operators "activities" are reported as limited to loading the stations. Carrier is said to be applicable to any of the company's units with ratings from 5 to 100 kw.

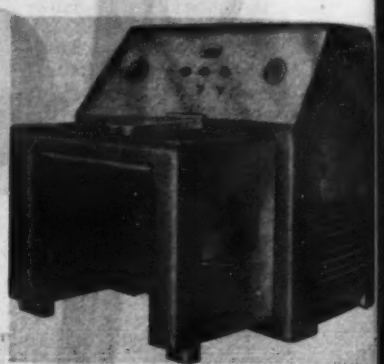
Hose Clamp

Type WWD stainless steel hose clamp. Wittek Manufacturing Co., Chicago 23, Ill.

Worm drive hose clamp has an inner band of stainless steel which protects the hose from the serrations in the outer band and distributes the load uniformly. This is said to provide greater strength and better sealing characteristics. It has a compact streamlined housing and hardened one-piece thumbscrew. Clamp is made in eight adjustable sizes which is said to cover all applications.

•

Induction Heater



H. F. induction heater: 15 kw.; supply 220 volt; frequency range 100,000 to 300,000 cycles; foot switch; automatic timer; meters and switches cabinet mounted; calibrated tuning control. American Type Founders, Industrial Products Division, 3906 Hudson Blvd., Union City, New Jersey

High frequency converter for induction heating of ferrous and nonferrous metals. Five stops on the p.f. tap switch are said to limit output to job needs—8, 9½, 11, 12½, 14 and 16 kw. available. Unit is equipped with 18 kva. transformer which is protected by a matching reactor. A 1-kva. auto-transformer in an independent circuit steps voltage down for control and safety circuits. High frequency is developed by charging a bank of capacitors which subsequently discharge across a set of water cooled and air cooled spark gaps.

•

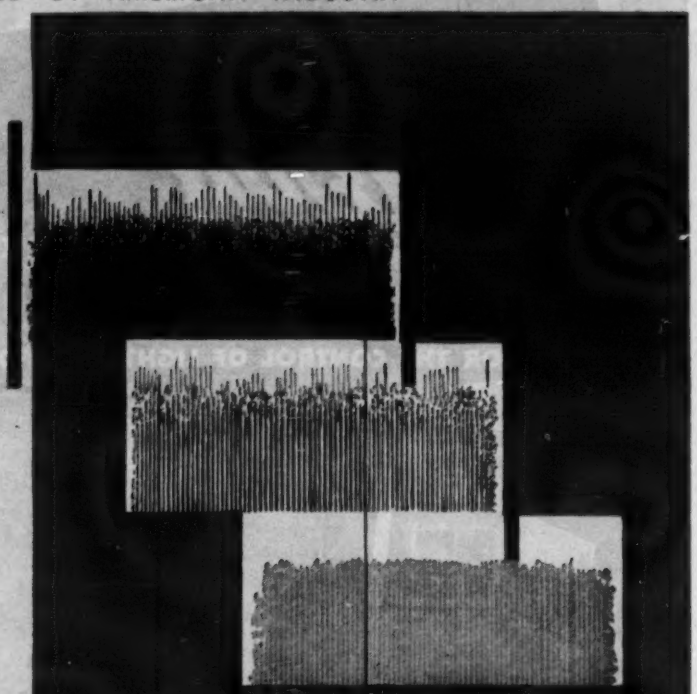
Spring Steel Latch

No. 1663 spring steel speed nut latch. Tinnerman Products, Inc., 2119 Fulton Rd., Cleveland 13, Ohio.

Latch developed for ease of attachment and removal of box covers, access doors, panels and inspection plates. Spring arms snap the ball on grooved studs to attach and pulling allows quick withdrawal. Nut is available in five thicknesses for various pull-out tension requirements. Three styles of ball studs are available—drilled and tapped for 6-32 screws, threaded shanks, and plain shank for riveting.

ONE OF THE MANY DOW CHEMICALS USED BY AMERICAN INDUSTRY

they "tend to their knitting" and make a better yarn!



A TYPICAL DOW BATTLE AGAINST MOLD

Manufacturers bothered by mold problems may learn a profitable lesson from textile weavers.

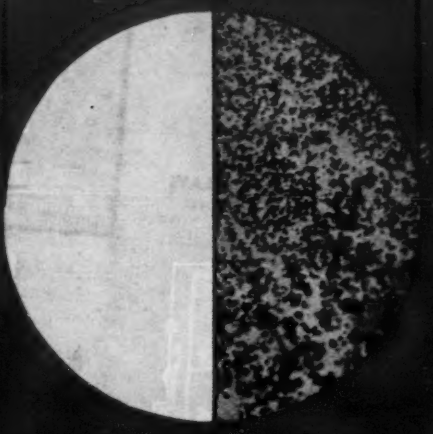
When fabric is woven, warp yarns must be stiff to enable the shuttle carrying the filler yarns to pass through without abrasion which causes wear and possible fracture of the yarn. To make it stiff, yarn is subjected to a process called "slashing" which consists of running it through a solution containing starch and oil. Naturally, the mixture is subject to mold and bacterial attack but, in addition, yarns sized with it may also be affected causing loss in tensile strength and possible discoloring due to mold stain.

Dow technicians experimented, tested, experimented more, tested more—and presented the answer . . . Dowicide. Today, this effective product protects slashing solutions . . . better fabrics woven by the textile industry are proof of another victory in the never-ending battle against mold.

Dow technicians and specific Dowicide products are ready to fight mold wherever it rears its head—in the paper, paint, lumber and other industries. If you have a mold problem, get in touch with us.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle



Dowicide

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

HERE ARE SOME OF THE
Federal
NOARK
ELECTRIC PRODUCTS
FOR THE CONTROL OF LIGHT AND POWER
SERVICE EQUIPMENT
All Sequences and Types for the Various Utility Requirements
INDUSTRIAL CONTROLS
For Motors up to 50 H.P.
CONTACTORS AND RELAYS
From 1 to 100 Amperes
MULTI-BREAKERS
For Home Lighting and Small Motor Circuits. Types MO, M, MB, M1, M2
SAFETY SWITCHES
In Types A-C-D from 30 to 1200 Amperes Single and Double Throw
TYPE AB-1 CIRCUIT BREAKERS
For AC and DC Lighting and Power Circuits
METERING EQUIPMENT
Socket Type and Other Standard Designs of Metering Equipment
PANELBOARDS
For Light and Power Distribution—Fusable and Circuit Breaker Types
FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
Executive Offices: 50 Paris St., Newark 5, N. J. • Plants: Hartford, Conn., Newark, N. J.
Manufacturers of Motor Controls, Safety Switches, Circuit Breakers, Service Equipment, Panelboards

TECHNICAL LITERATURE

Welding—Copies of a 4-page folder entitled "Low Temperature Welding Alloys" can be secured by writing Dept. A-1 Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y. It contains data on specific applications, uses and specifications on design and procedure of various rods. Also contains a full-page assortment chart to assist engineers, technicians and welders in selecting the proper rod for a particular job.

Ceramics—Bulletin No. 444, "Ceramics for Electrical and Other Technical Uses," is available from the American Lava Corp., Chattanooga, Tenn. Contains physical and electrical characteristics of ceramic insulators in a handy form for engineers, designers and research men as well making it an informative guide for purchasing agents. Applications illustrated are in electrical, electronics, industrial heating, chemical, automotive and other fields.

Radiant Heating—A 52-page booklet entitled "Byers Wrought Iron for Radiant Heating" contains chapters on history, theory and advantages of radiant heating as well as information on temperature distribution, comparative costs, and calculations and design of radiant heat installations. Copies may be secured from A. M. Byers Co., Pittsburgh, Pa.

Steam Guide—Planning information on 10,000 to 60,000-kw. condensing turbines, surface condensers and auxiliaries, for building a new plant or adding generator capacity to an existing one, is contained in the Steam Power Plant Planning Guide which is procurable from the Westinghouse Electric & Mfg. Co., Pittsburgh 30, Pa. Part One of the 40-page booklet illustrates types of turbines, and charts their sizes and speeds. Part Two on performance data covers basic operating conditions, including effect of deviation in pressures and temperatures on heat rates; regenerative feed-water heating; recommended condenser sizes, and condenser dimensions, condenser friction; impeller, propeller and axial type circulating pumps; and condensate pumps. Data is presented in chart and table form for easy selection.

Standards—Publication, NEMA Power Switching Equipment Standards No. 45-94 supersedes previous publication No. 41-45. Contains practical information on construction, test, performance and manufacturing of power switching equipment. Copies may be secured from National Electrical Manufacturing Association, 155 East 44th St., New York 17, N. Y. for $2.50 per copy.

Microphones—Basic operating principles of microphones are explained in the new catalog of the Electro-Voice Corp., 1239 South Bend Ave., South Bend 24, Ind. It serves as a guide to the proper selection of types for specific applications. New types of special purpose microphones which are illustrated make it a handbook for "sound" men.

Standards — New pamphlet entitled "Commercial Electric-Refrigeration Condensing Units," Commercial Standard CS 107-45 (supersedes pamphlet CS(E) 107-43) may be obtained for 10 cents per copy from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Standards cover minimum requirements, rating, motor loading, and testing of air-cooled and water-cooled, belt driven commercial electrical-refrigeration condensing units, in ¼-to 3 hp. sizes, and water-cooled units of 5 hp., using methyl chloride, Freon 12, and SO_2 refrigerants.

SAFETY SERVICE SIMPLICITY . . .

. . . watchwords of TIPS TOOL designers

The dead end Strain Carrier illustrated here is a typical example of the simplicity, safety and serviceability of all Tips Hot Line Tools.

This tool was designed to simplify the replacing of damaged dead end insulators on low voltage, light construction transmission lines without interrupting service. It is so simple that insulator changes have been made with it in ten minutes from start to finish. It is completely safe because it is easily applied at a safe distance from conductors. It is light weight but sturdy and serviceable and it can be applied to pole or cross arm dead ends even where space is limited.

For the most part, this device was the brain child of Tips Tool Design Engineers, but it followed the usual development procedures typical of all Tips Tools. It was born of necessity and developed by improving on older ideas and combining them with new ones. Many tests, field trials and alterations were made before the final masterpiece was ready for production.

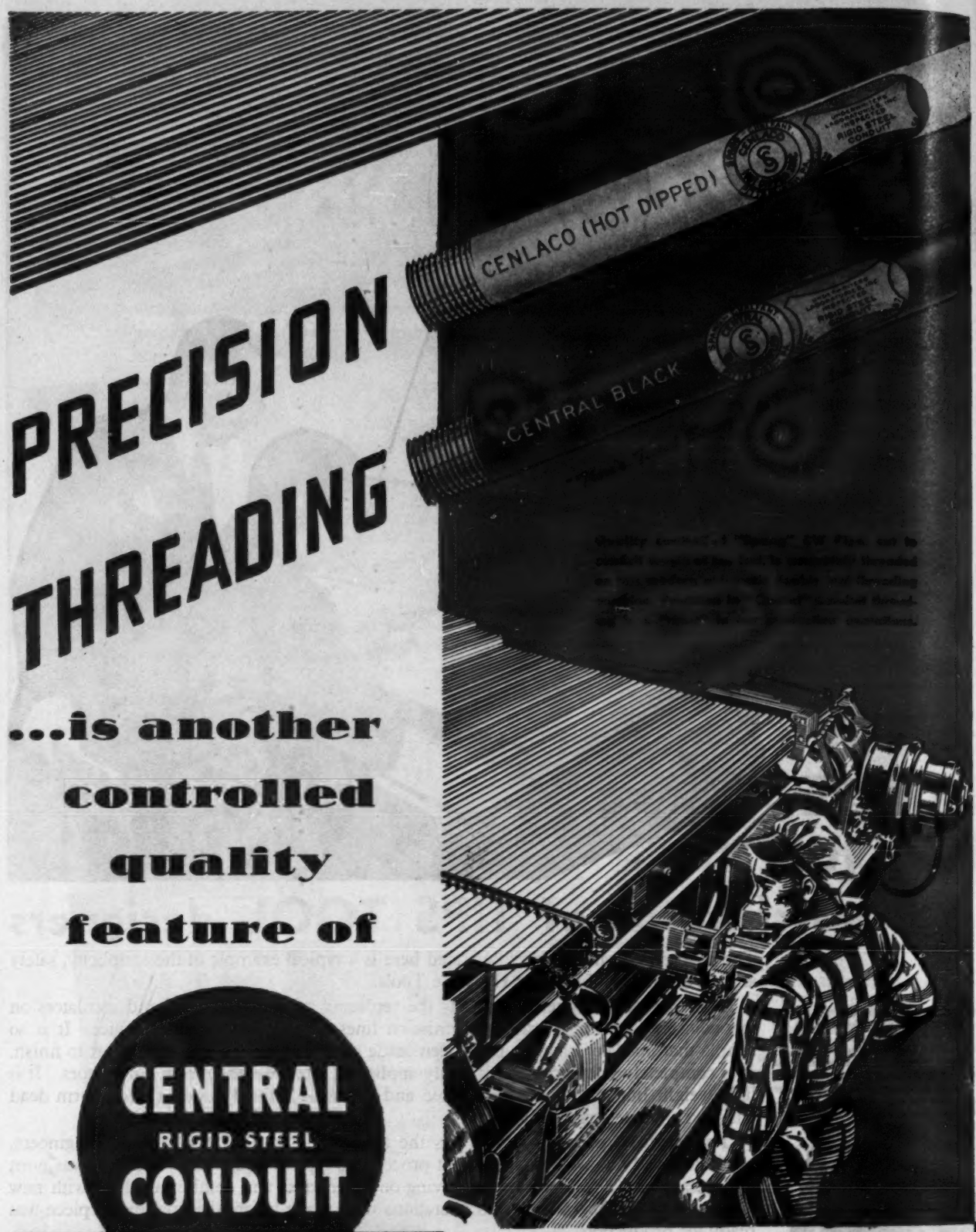
Our point is simply this—All hot line tools which bear the Tips Tool trademark are completely dependable because they are designed by experts who demand the ultimate in simplicity, safety and serviceability.

"THERE'S NOTHING TOO GOOD WHERE LIFE IS AT STAKE"

Consult this Tips Tool Catalog of Electrical Live Line Equipment for detailed information on the selection of tools and the methods for doing a variety of hot line maintenance jobs. It has sixteen pages of "how to do it" information on twenty-four different repair jobs.

If you do not have a copy or one of our Master Catalogs—where the same information is available—send for yours today.

A·B·CHANCE CO·
CENTRALIA, MISSOURI.



PRECISION THREADING

...is another controlled quality feature of

CENTRAL
RIGID STEEL
CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
General Sales Office: Grant Building, Pittsburgh 30, Pa.
District Offices and Sales Representatives in Principal Cities

NEWS ABOUT PEOPLE

. R. Parrack Joins Staff of Florida Power Corp.

V. R. Parrack, formerly system distri-tion engineer for the Virginia Pub- Service Co. at Charlottesville, has en appointed superintendent of dis-ibution for the Florida Power Corp.

ith headquarters in St. Petersburg. Previous to his association with the irginia utility, Mr. Parrack spent nine ars as distribution design engineer ith the Carolina Power & Light Co. e is a graduate of the University of irginia.

•

▶ HOYT W. GALE, JR., has been ap-ointed manager of the newly organized ersonnel department of the Delaware ower & Light Co., Wilmington, Del. rior to joining Delaware Power, Mr. ale was associated with the Nicaro ickel Co. in Wilmington. He attended ennison University and the University f Pittsburgh. Before going to Wilming-on last fall, Mr. Gale was associated ith the Gale Company, insurance brok-rs in Cleveland, Ohio, and the Basic agnesium Corp., Las Vegas, Nev.

▶ N. A. ROLLINS, staff engineer, engi-eering department, Commonwealth dison Co., Chicago, Ill., has retired. r. Rollins entered the employ of the dison company as a draftsman in 1904. e was made field engineer in 1927 and in 1935 as plant installation engineer was put in charge of the installation of all the station, substation, and outside plant equipment for the company. He became staff engineer in 1943.

▶ IRVING K. HARRIS, until recently power director at Boulder Dam, has been appointed acting construction engineer at Shasta Dam to succeed RALPH LOWRY, recently promoted to assistant chief engineer of the Bureau of Reclamation with headquarters in Denver, Colo. Mr. Harris will be in charge of the Shasta power plant, location and construction of transmission lines and operation of the facilities. Before joining the reclamation service in 1909, Mr. Harris was associated with the Edison Electric Co., now the Southern California Edison Co., and from 1917 to 1933 he was a consulting engineer in Los Angeles. From 1912 to 1914 he was engineer in charge of the power division of the Salt River Project in Arizona.

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J. R. Ketchel Promoted by New Jersey Utility

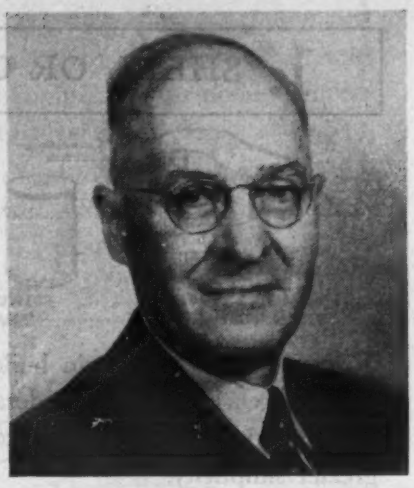
J. Raymond Ketchel, who has been acting superintendent of production for the Jersey Central Power & Light Co. since last August, has been named general superintendent of production. Mr. Ketchel, whose headquarters are at the South Amboy plant of the company, succeeds George T. Bromley, retired. Mr. Ketchel had served as assistant to Mr. Bromley since 1934, becoming acting superintendent upon Mr. Bromley's retirement.

Mr. Ketchel has been connected with Jersey Central properties since 1926 when he superintended work on the Whippany electric plant as a member of the Electric Management & Engineering Co. When the plant was completed he took the position as resident engineer with Jersey Central. In 1931 he became superintendent of construction of the South Amboy plant and afterwards was in charge of plant improvement for the whole territory. Mr. Ketchel is a member of the American Society of Mechanical Engineers.

C. P. Garman Appointed Chief Electrical Engineer

Appointment of Charles P. Garman as chief electrical engineer and a deputy general manager of the Los Angeles (Calif.) Department of Water and Power has been announced by the city's Board of Water and Power Commissioners.

Mr. Garman, who studied electrical engineering at the University of South-



ern California, worked for electric utilities and manufacturing companies prior to joining the Los Angeles Department of Water and Power as an electrical draftsman in 1920. He has been acting head of the power system since R. R. Robertson retired eight months ago. He is a member of the American Institute of Electrical Engineers.

Simultaneously with the promotion of Mr. Garman, the Commissioners voted unanimously for the selection of Laurence E. Goit as chief engineer of water works and deputy general manager of the entire department. He succeeds W. L. Hurlbut, who retired April 1.

A graduate of Lewis Institute of Chicago, Mr. Goit has been with the Water and Power Department since 1924.

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▶ ROBERT M. COOPER, formerly general manager of the Santee-Cooper hydroelectric development, Columbia, S. C., has been elected director of the new State Research, Planning and Development Board.

▶ WALTER O. ZERVAS, managing director of the Electric League of Indianapolis, Inc., since 1940 has resigned, effective June 1, to take a position with the American Iron & Steel Institute of New York City. He will direct research and promotional activities of the Institute in the uses of steel for electrical systems. A graduate of the University of Wisconsin, Mr. Zervas has been engaged

A Power Transformer

Designing a Sturdy, Reliable as Much on Common Sense as on

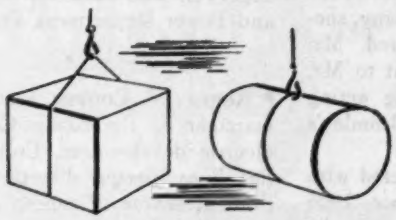
1. SHELL OR CORE?

THERE IS GREAT merit in building transformers *both* ways. For small, moderate voltage transformers, the core type is recommended by its greater simplicity.

For large, high voltage transformers, shell type design is recommended because:

1) Vertical coil discs give less capacitance to ground...more uniform voltage distribution. 2) Shell type design provides sturdy bracing against over-currents. 3) Use of solid insulation between coils in combination with oil ducts means highest dielectric strength.

2. NO CORNERS ...LESS SLACK



JUST AS IT IS easier to pull a rope tight around a barrel than a packing case, so circular coils can be wound more uniformly taut than rectangular ones. No pounding is needed to force the conductor around sharp corners — result is that no stress is built into the coil! That's one reason why Allis-Chalmers applies *circular coil construction* to all its power transformers.

Another reason — circular coils, unlike oval or rectangular coils, have no tendency to distort under short circuit conditions.

3. SURGE PROTECTION FITS LIKE A DIME ON A STACK OF PENNIES

WHEN AN UNSHIELDED transformer is struck by a voltage surge, the turns next to the line may take more than their share of punishment from voltage stress.

While the overall design of a shell type transformer smooths out the voltage distribution curve, Allis-Chalmers provides *added* surge protection in the form of a simple shielding plate, which is connected to the line and placed next to the line-end turns.

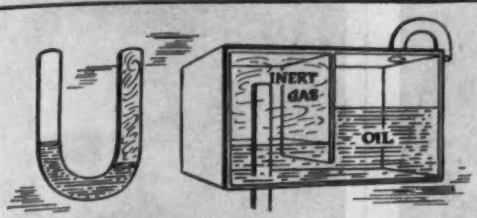
The shield is a flat disc insulated and installed the same as the coil discs, so that it cannot interfere with free oil circulation or in any way complicate the transformer assembly. The combination of shell type design and shield gives ideal simple surge protection.

Invest in ALLIS-CHALMERS

Isn't All Mathematics

Power Transformer Depends Number Sense . . . For Example:

4. VALVELESS INERT GAS SYSTEM



YOU NEEDN'T think in terms of increased maintenance when considering inert gas protection for transformer oil.

As an alternative to a high pressure system, Allis-Chalmers recommends the use of its simple Oil-Sealed inert gas system . . . with no complicated valve mechanisms, high pressure tanks, or moving parts to wear and cause trouble. Maintenance on the Oil-Sealed inert gas-protected transformer is no greater than for a transformer with conventional expansion tank!

5. METAL-TO-METAL CONTACT AT GASKETED JOINTS

HOW WELL gaskets perform their function of keeping joints in a transformer tank oil-tight largely depends on how much they are compressed.

Conventional gasketing (see artist's sketch) may result in over-compression or under-compression — and oil leaks in either case.

Allis-Chalmers metal-to-metal contact at gasketed joints insures *most efficient* gasket compression . . . prevents stress on gaskets . . . means longer-lasting protection against oil leaks.

6. SAFE . . . CONVENIENT

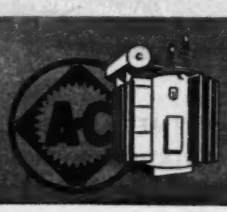
THE NO-LOAD tap changer handle may be placed either on the cover of a transformer or on the side of the tank. On Allis-Chalmers transformers, the no-load tap changer is always arranged with operating handle and position plate mounted *on the side.*

Thus tap positions can be observed from the ground level while the transformer is in service—no danger to personnel from approaching high voltage bushings. Tap positions are easily changed, too.

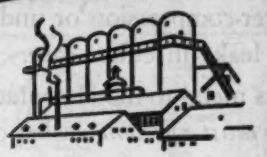
For the full story on power transformers, call your nearby A-C district office, or write ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A 1790

Power Transformers



MECHANICAL GUARDIANS FOR ALL KINDS OF PIPE LINES



In chemical industries, synthetic rubber plants, oil refineries . . . any plant, piping precious or potentially hazardous fluids . . . a mistake, whether unintentional or deliberate, in adjusting a pipeline valve can prove both dangerous and costly. But prevention of these human errors is easy and infallible with BENDIX-CORY* SAFETY INTERLOCKS . . . the locks that say "No!" to unauthorized handling of your valves.

The BENDIX-CORY SAFETY INTERLOCK illustrated gives absolute control over the opening and closing of the valve to which it is attached . . . and, by use of an interlock key, can also control the position of this valve in relation to any number of other valves. The unit is wholly mechanical, and fully adjustable to compensate for valve wear—one of a number of interlocks specially designed for valve protection.

BENDIX-CORY SAFETY INTERLOCKS are dependable guardians for your pipelines. Write for full information.

*TRADE-MARK OF BENDIX AVIATION CORPORATION

CHECK THESE FEATURES

✓ Interlocks stem valves 2" to 8". Other interlocks for globe, lead and porcelain valves.

✓ Absolute control of valve opening and closing under all conditions.

✓ Positions valve in relation to other valves.

✓ Ample strength characteristics.

✓ Indoor or outdoor installation without removing valve from service.

✓ Fully mechanical. No electric circuit.

✓ Position indicator (not shown) shows valve open or closed.

✓ Adjustable compensation for valve wear.

MARINE DIVISION
BENDIX AVIATION CORPORATION
106 Nostrand St., Brooklyn 5, N. Y.

Bendix-Marine INSTRUMENTS CONTROLS

in electrical organization and promotion work for 23 years. Before going to Indianapolis in 1940 he was successively commercial field survey supervisor of the Wisconsin Telephone Co., manager of the Electric League of Milwaukee and in charge of load building for the Rural Electrification Administration of Wisconsin.

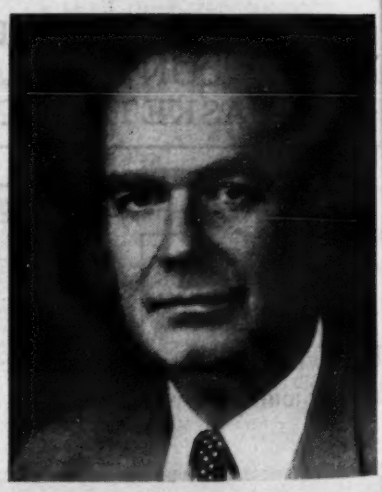
Roebling's Sons Appoints Three Vice-Presidents

Announcement has been made by the John A. Roebling's Sons Co., Trenton, N. J., of the election of three new vice-presidents. They are Ernest C. Low,

E. C. Low

general manager of sales; Charles M. Jones, manager of engineering, and John D. Thompson, works manager. Archibald W. Brown, treasurer since 1902, has been elected a director of the company.

Mr. Low has been identified with the

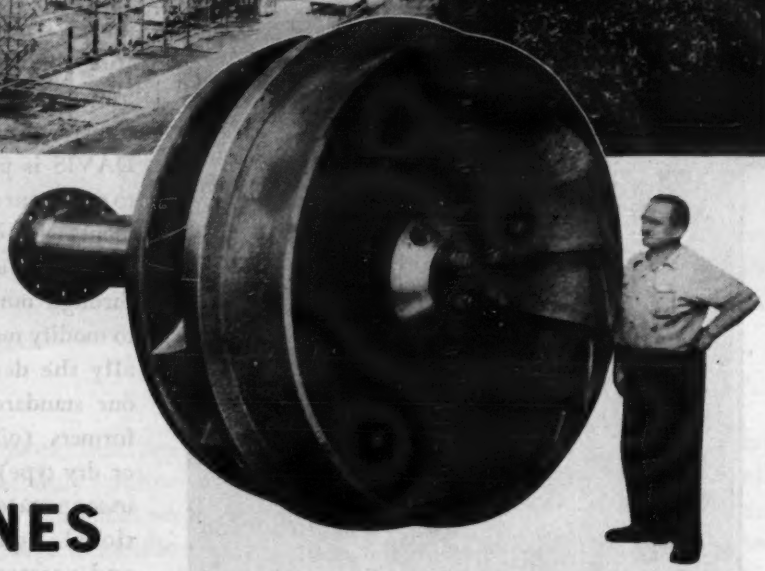


C. M. Jones

Roebling organization for 35 years. Joining the California division at Los Angeles, he served in various sales capacities. He was appointed manager of

The Highest Head* Francis Turbine in the Americas

*1028 Feet Head . . . 39,000 hp.
Intapanlongo Development, Mexico



Harnessed by

BALDWIN TURBINES

Baldwin Turbines—of all types—are operating under the complete range of heads.

Baldwin's engineering experience can determine and provide the most economical application for your plant.

THE BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA, PENNSYLVANIA, U. S. A.

I. P. MORRIS DEPARTMENT, EDDYSTONE, PA. • THE PELTON WATER WHEEL CO., SAN FRANCISCO, CAL.

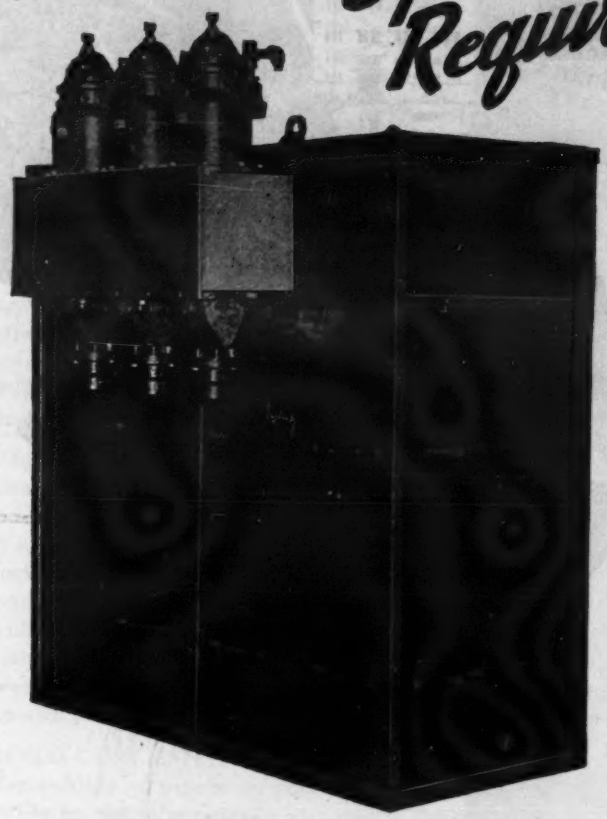
BLW THE BALDWIN GROUP **BALDWIN**

HYDRAULIC TURBINES

NO. 5 OF A SERIES ON THE *Service Superiority* OF

DAVIS TRANSFORMERS

Modifying Standard Designs to meet *Special Requirements.*



★ **500 KVA DRY TYPE** (Natural Draft Cooled) Davis Transformer, Class "B" insulated, three phase, 2400-480 volt. Secure advantages of complete unit metal enclosed construction with CUT-OUT BOX attached to transformer.

Installation labor reduced by merely terminating feed cables in potheads or within cut-out insulators inside box. Conduit connections can be made on pothead or directly on box.

An economical primary load-break oil switch with overload and short circuit fuse protection.

When special operating conditions call for modification in transformer design, DAVIS is prepared to meet your requirements. You can save both money and time through our ability to modify mechanically the design of our standard transformers (oil-cooled or dry type) and to incorporate additional equipment and accessories to meet your special conditions. If you will consult our Engineering and Manufacturing Divisions we will be glad to give you the benefit of our many years of experience.

DAVIS TRANSFORMER COMPANY

DAVIS TRANSFORMER CO.
Phone 177 CONCORD, N. H.

and

NEMA — National Electrical Manufacturers Association — Member

STOCKWELL TRANSFORMER CORP.
CONCORD, N. H.—Phone 177 AKRON, OHIO—Phone Jefferson 4179

Manufacturers of Oil Cooled, Dry Type, Power and Distribution Transformers
Also All Types of Specialty Transformers Regardless of Size

the San Francisco branch in 1930, a... in 1940 was elected president and g... eral manager of John A. Roebling... Sons Co. of California. When he w...

J. D. Thompson

made general manager of sales in 194... he made his headquarters in Trenton.

Mr. Jones has been identified with th... Roebling organization since 1926 an... Mr. Thompson since 1940.

•

▶ HARRY J. FEY has been appointed a... vertising manager of the James F... Kearney Corp., St. Louis. Mr. Fey ha... been a member of the Kearney adverti... ing department since 1932. He is wel... known to industrial advertising me... through his active participation in th... affairs of the St. Louis Chapter o... National Industrial Advertisers Asso... ciation during the past eight years, an... has to his credit several N.I.A.A. certifi... cates of awards for outstanding indus... trial advertising campaigns and cata... logs.

▶ WILLIAM F. LISMAN, vice-presiden... and general manager of the Leland... Electric Co., Dayton, Ohio, has bee... elected president and general manage... of the company. Mr. Lisman joined... Leland in 1933 and was formerly in th... sales and engineering departments o... General Electric Co.

▶ NATHAN M. KEADLE, project superin... tendent of the Mitchell County Electri... Corporation, which serves rural resi... dents in six southwest Georgia counties... has resigned.

▶ VINCENT T. MILES has been elected... treasurer of the Long Island Lighting... Co., Mineola, N. Y., and its affiliates.

▶ JAY C. WARNER has been appointed... to assist in the development of sales for... the Allis-Chalmers Manufacturing Co.... in the Far East, Australia and New...

"No Experience Necessary"

That's a phrase we're borrowing from the "Help Wanted" columns, for it certainly applies to Bethlehem's new serving tool . . . a tool so easy to use that any lineman can learn to handle it in a few minutes' time.

As the illustration shows, the device makes possible a neat, tremendously strong serve by means of the dead-end coil method. Using a 10-foot coil of 11-gage bethanized dead-end wire, the lineman hooks one end in place on the strand; then, engaging the wire between the fingers of the serving tool, he wraps it solidly in place with a simple rotary motion. Exhaustive tests have proved conclusively that the serve holds beyond the useful strength of the strand.

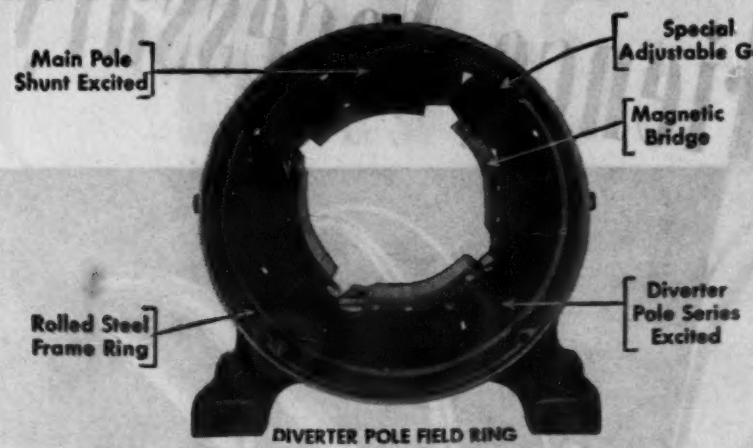
After a little practice, the lineman can make his serve in about the time required to attach conventional clamps. Besides, this serve is considerably more economical than the clamp method, for a coil of the necessary wire costs less than even a single inexpensive clamp.

The serving-tool technique is especially recommended for use with *bethanized* strand and wire—manufactured by Bethlehem Steel Company. One reason is that the highly ductile, uniform bethanized coating (almost 100 per cent pure zinc, applied electrolytically) is not displaced to any harmful extent by the operation of the serving tool. Moreover, when bethanized strand and dead-end wire are used, there is no question about the holding power of the serve.

Write for more details—or, better still, ask the nearest Bethlehem representative to explain this simple, effective technique.

★ ★ BETHLEHEM STEEL ★ ★

WHAT IS GOOD BATTERY CHARGING?



DIVERTER POLE FIELD RING

Your Answer is Found In The DIVERTER POLE MOTOR-GENERATOR

What is Required Of A Standby Battery Charger

A—Must provide a closely regulated charging rate, enough to compensate for losses and maintain the battery in a healthy fully charged condition.

B—Must be fully automatic in operation requiring only periodic inspection.

C—Must be dependable to the extreme.

D—Must reduce to a minimum transmission of any noises to the circuits and must be mechanically quiet.

E—Should share all loads within safe capacity with the battery and shift excess load onto the battery.

F—Must be inherently protected from any damage or variation of characteristics in the event of a discharge of the battery through the generator.

What the DIVERTER POLE MOTOR-GENERATOR Provides

A—A closely controlled charging rate is dependent on a constant charging voltage at all times, which is an inherent feature of the Diverter pole generator.

B—Automatic operation is dependent on the inherent characteristics of the charger, which will repeat exactly, indefinitely. This is fundamentally characteristic of the Diverter Pole generator.

C—Dependability is primarily a function of mechanical and electrical design. The Diverter Pole Generator is unusually conservative as evidenced by very low temperature rise and all manufacturing operations are most carefully inspected and tested to meet the highest standards.

D—The Diverter Pole provides this mechanically by design requiring only a gentle motion of air for adequate cooling—electrically by a knowledge of the design factors controlling electrical circuit noises.

E—This means a constant charging voltage over the working range of the machine and an abrupt drop in voltage at all loads in excess of safe capacity. The action of the Diverter Pole field with the magnetic bridge provides this inherently in the Diverter Pole.

F—The Diverter Pole principle eliminating a compounding field permits armature current flow in the reverse direction without change of magnetic polarities. With the Diverter Pole principle, protection from severe overloading is secured by a drop in voltage to relieve and protect the Motor-Generator.

Send for Bulletin No. 96A For Complete Details—

The Electric Products Co.
1731 CLARKSTONE ROAD · CLEVELAND 12, OHIO

Zealand, according to announcement by Paul Dietz, export sales manager for the general machinery division of the company. Mr. Warner has had several years experience in the sale of machinery in the Far East and Latin America. He has just spent two years in Brazil with the Defense Supplies Corporation of the U. S. Government.

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Warren Returns as Head of Royal Electric Co.

Announcement has been made by the Royal Electric Manufacturing Co., Chicago, that P. L. Warren has returned as head of that organization, assuming the title of president and treasurer.

Commander Warren was recently granted his release from the Navy Department where he had completed the duties for the performance of which the Navy Department had requested a leave of absence.

Mr. Warren became identified with Royal Electric in 1936, having been previously associated with the Otis Brass Co.

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▶T. B. MARTIN has been appointed director of advertising for both the Detroit and Milwaukee electrical divisions of the Square D Co. He will continue to have his headquarters at the Milwaukee plant from which office he has been serving Square D since 1929 as sales manager of the industrial controller division. For seven years prior to that time, Mr. Martin was in charge of the Milwaukee office of the Industrial Controller Co., joining Square D when the two companies merged in 1929. Dwight A Roehm will continue his advertising activities for the Detroit plant under the title, advertising manager, Detroit Division. Likewise, J. Clifton Carr continues in his capacity of advertising manager of the Kollsman Division of Square D, with headquarters in Elm-

TROUBLE PREDICTED

COMPLAINTS FORESTALLED

DEFECTS REVEALED

Bristol's All-Purpose Portable Voltmeter gives you a convenient means of quickly analyzing conditions, making voltage surveys, general testing, investigating complaints — helping you to maintain a high standard of voltage regulation.

Double-record Voltmeters help check the balance on three-wire systems and to study voltage drop in a section of the circuit.

Three-record Voltmeters are used in investigating conditions in three separate circuits or in polyphase networks, and for determining voltages at load centers and ends of feeders.

BRISTOL'S ALL-PURPOSE PORTABLE VOLTMETER

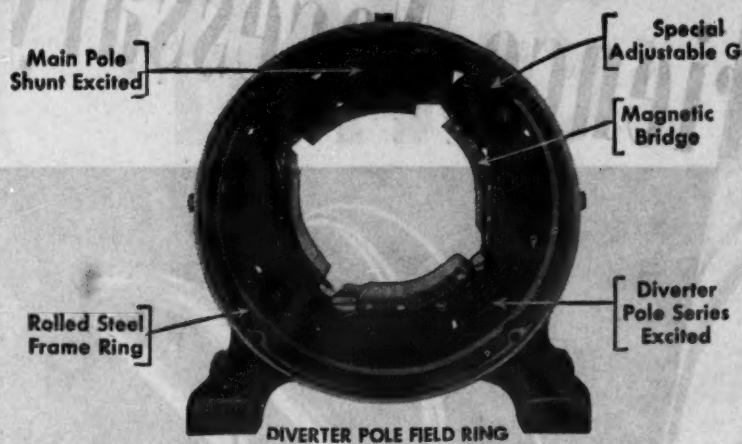
Easy to handle — weighs only 17 pounds. Can be carried anywhere, mounted anywhere — outdoors or on a damp cellar floor. Will take constant handling without affecting accuracy.

Bulletin E1100 describes replaceable measuring element, gravity-controlled pen pressure, fine-bore platinum-tip fountain pens, integral resistors. Address THE BRISTOL COMPANY, 116 Bristol Rd., Waterbury 91, Conn. (The Bristol Co. of Canada, Ltd., Toronto, Ont. Bristol's Instrument Co., Ltd., London, N. W. 10, England). Makers of Metameter, Recording Ammeters and Voltmeters, Thermoverter, and a broad line of automatic controlling and recording instruments.

Gives You the Facts when and where you want them

AUTOMATIC RECORDING AND CONTROLLING INSTRUMENTS

WHAT IS GOOD BATTERY CHARGING?



DIVERTER POLE FIELD RING

Your Answer is Found In The DIVERTER POLE MOTOR-GENERATOR

What is Required Of A Standby Battery Charger	What the DIVERTER POLE MOTOR-GENERATOR Provides
A—Must provide a closely regulated charging rate, enough to compensate for losses and maintain the battery in a healthy fully charged condition.	**A**—A closely controlled charging rate is dependent on a constant charging voltage at all times, which is an inherent feature of the Diverter pole generator.
B—Must be fully automatic in operation requiring only periodic inspection.	**B**—Automatic operation is dependent on the inherent characteristics of the charger, which will repeat exactly, indefinitely. This is fundamentally characteristic of the Diverter Pole generator.
C—Must be dependable to the extreme.	**C**—Dependability is primarily a function of mechanical and electrical design. The Diverter Pole Generator is unusually conservative as evidenced by very low temperature rise and all manufacturing operations are most carefully inspected and tested to meet the highest standards.
D—Must reduce to a minimum transmission of any noises to the circuits and must be mechanically quiet.	**D**—The Diverter Pole provides this mechanically by design requiring only a gentle motion of air for adequate cooling — electrically by a knowledge of the design factors controlling electrical circuit noises.
E—Should share all loads within safe capacity with the battery and shift excess load onto the battery.	**E**—This means a constant charging voltage over the working range of the machine and an abrupt drop in voltage at all loads in excess of safe capacity. The action of the Diverter Pole field with the magnetic bridge provides this inherently in the Diverter Pole.
F—Must be inherently protected from any damage or variation of characteristics in the event of a discharge of the battery through the generator.	**F**—The Diverter Pole principle eliminating a compounding field permits armature current flow in the reverse direction without change of magnetic polarities. With the Diverter Pole principle, protection from severe overloading is secured by a drop in voltage to relieve and protect the Motor-Generator.

Send for Bulletin No. 96A For Complete Details—

The Electric Products Co.
1731 CLARKSTONE ROAD · CLEVELAND 12, OHIO

Zealand, according to announcement by Paul Dietz, export sales manager for the general machinery division of the company. Mr. Warner has had several years experience in the sale of machinery in the Far East and Latin America. He has just spent two years in Brazil with the Defense Supplies Corporation of the U. S. Government.

•

Warren Returns as Head of Royal Electric Co.

Announcement has been made by the Royal Electric Manufacturing Co., Chicago, that P. L. Warren has returned as head of that organization, assuming the title of president and treasurer.

Commander Warren was recently granted his release from the Navy Department where he had completed the duties for the performance of which the Navy Department had requested a leave of absence.

Mr. Warren became identified with Royal Electric in 1936, having been previously associated with the Ohio Brass Co.

•

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Gives You the Facts when and where you want them

AUTOMATIC RECORDING AND CONTROLLING INSTRUMENTS

KLEINS

FOR MEN WHO WANT THE BEST

Demanding the best in tools and equipment has long been a tradition of the electrical industry. It is significant that linemen and electricians today rely on Klein Pliers—Klein Climbers—Klein Belts—Klein Safety Straps just as the pioneers in this field did when electricity was in the era of its first expansion.

To the man on the pole, the name Klein still means reliability plus a high factor of safety in the equipment he uses.

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp., New York

This book on the care and safe use of tools will be sent on request

Since 1857

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

hurst, N. Y. Frank Roby, who left ... Industrial Controller Division in ... to enter the armed services, has ... joined the Square D Company as ... manager of that division, with ... quarters in Milwaukee.

•

Major Appliances Names New Sales Manag...

Announcement has been made of ... appointment of D. C. Cunningham ... the position of general sales manag... of Major Appliances, Inc., one of ... leading distributors in Florida ... headquarters in Miami and branches ... Tampa and Jacksonville.

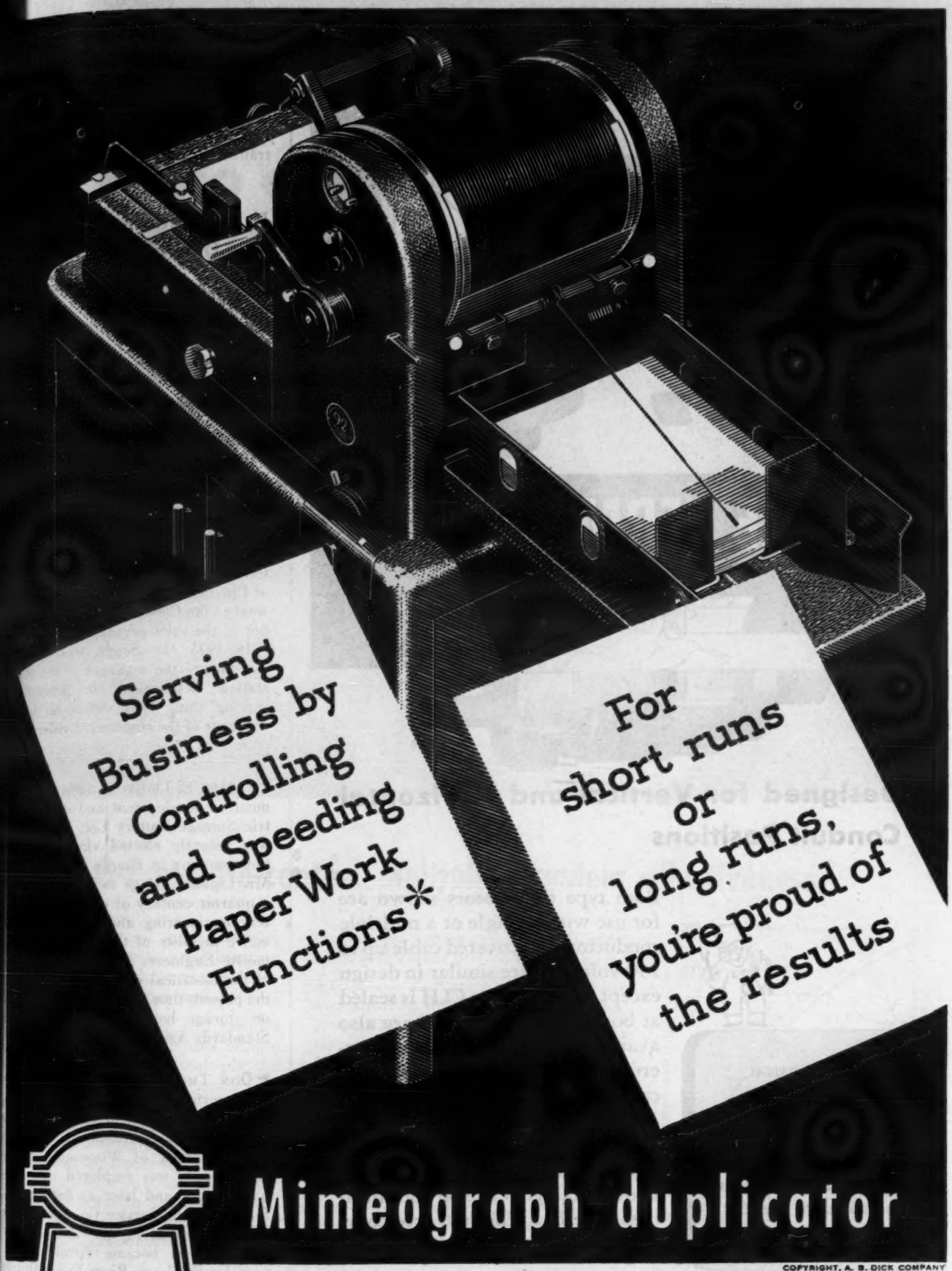
Mr. Cunningham has a background ... 25 years in the merchandising of maj... appliances and is thoroughly familia...

D. C. Cunningham

with dealers' problems. He and his as... sociates operated an appliance distribut... ing and retailing company in Syracus... for many years, following which he be... came New York State manager, eastern... sales manager and general sales man... ager of Gainaday Electric Co. of Pitts... burgh. For the past 13 years he has... served as divisional sales manager for... Easy Washing Machine Corp., Syracuse, ... and during the past five years has been ... southern divisional sales manager with ... headquarters in Atlanta.

•

▶ W. R. Persons has been appointed ... assistant sales manager of the Lincoln ... Electric Co., Cleveland, Ohio. In this ... capacity, he will act as assistant to C. ... M. Taylor, vice-president and general ... sales manager. Mr. Persons will as... sume the responsibility of developing ... certain specific fields for Lincoln pro... ducts. In this connection he has been ... working on special assignments since ... his transfer to the Lincoln home office ... at Cleveland several months ago. He ... has been with the company for the...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For short runs or long runs, you're proud of the results
Mimeograph duplicator

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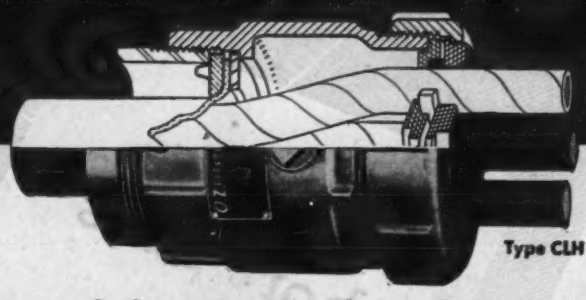
CABLE TERMINATORS



Designed for Vertical and Horizontal Conduit Positions

O.Z. ELECTRICAL PRODUCTS

- CONDUIT FITTINGS
- CABLE TERMINATORS
- JUNCTION BOXES
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- POWER CONNECTORS

Both type terminators shown are for use with a single or a multiple conductor lead covered cable up to 750 volts and are similar in design except that the Type CLH is sealed at both ends. These types are also available for two or more lead covered cables and for rubber covered cables.

A number of other type terminators including a series for cables up to 2500 volt capacity are also listed in our catalog. Write on your business letterhead for your free copy.

7450

O.Z. ELECTRICAL MFG. CO.

262 BOND STREET · BROOKLYN, 2 N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

past ten years. After the Lincoln welding course, Mr. Persons was assigned to the position of sales and service representative in western Pennsylvania. Four years later he was appointed branch manager of the Pittsburgh office, continuing in that position until his tranfer to Cleveland last year.

•

R. C. Sogge Assumes New Duties in Schenectady

R. C. Sogge has been named assistant manager of General Electric's central station divisions, according to an announcement by W. V. O'Brien, manager of the divisions. In addition to his new position, Mr. Sogge will continue as manager of the customer division, central station divisions.

Mr. Sogge joined General Electric in 1916 as a testing engineer in the company's transformer department at Pittsfield, Mass., and a few months later went to the test department at Schenectady. Returning to the company after military service in World War I, he entered the transformer sales department at Pittsfield in 1919, and later that year went to the Cleveland district as a member of the sales personnel.

In 1925 Mr. Sogge was appointed assistant to the manager of the central station department at Schenectady, serving until 1934, when he became manager of the customer division.

•

▶ LESTER E. LIGHTON, manager department of development and design, Electric Storage Battery Co., Philadelphia, was recently elected vice-president of the company in charge of engineering. Mr. Lighton brings to his new position a quarter century of experience in battery engineering and sales. He is an active member of the Society of Automotive Engineers and is now a member of the electrical equipment division. At the present time he represents the S.A.E. on storage batteries in the American Standards Association.

▶ DON THOMAS has joined the Doble Engineering Co., Medford Hillside, Mass., as senior field engineer. He is a graduate in electrical engineering at the University of Wisconsin, and for seven years was employed in maintenance work and later as test engineer for the Public Service Co. of Oklahoma with headquarters at Lawton. Later Mr. Thomas became operating engineer for the Loup River Power District of Columbus, Neb., where he supervised production and transmission for the eastern division of the Nebraska grid, and was chairman of the Nebraska section of the A.I.E.E.

LOCATE radio dispatching stations for top performance

G-E remote-control multiplies system effectiveness

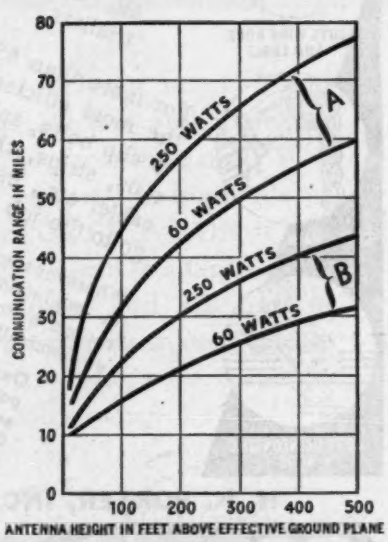
AN antenna placed at a carefully chosen low-noise-level location will pay big dividends in terms of increased 2-way radio coverage.

• A G-E remote-control unit enables you to take advantage of this simple and economical way to multiply the effectiveness of your radio system. This unit is designed to provide complete 2-way control of a remotely located transmitter and receiver by means of a simple two-wire line—at distances up to several miles. Thus, you can locate your radio station for maximum coverage—and your radio dispatcher can supervise his maintenance crews throughout your service area directly from his present service headquarters.

• Call your G-E sales engineer for information on the complete line of G-E 2-way FM communication equipment. Or write *Electronics Department, General Electric, Schenectady 5, New York.*

Government regulations now permit new installations of 2-way FM radio for important requirements of utility companies. Your G-E representative will help prepare your application.

Hear the G-E radio programs: *"The World Today" news, Monday through Friday, 6:45 p. m., EWT, CBS. "The G-E All-Girl Orchestra," Sunday 10 p. m., EWT, NBC. "The G-E House Party," Monday through Friday, 4 p. m., EWT, CBS.*



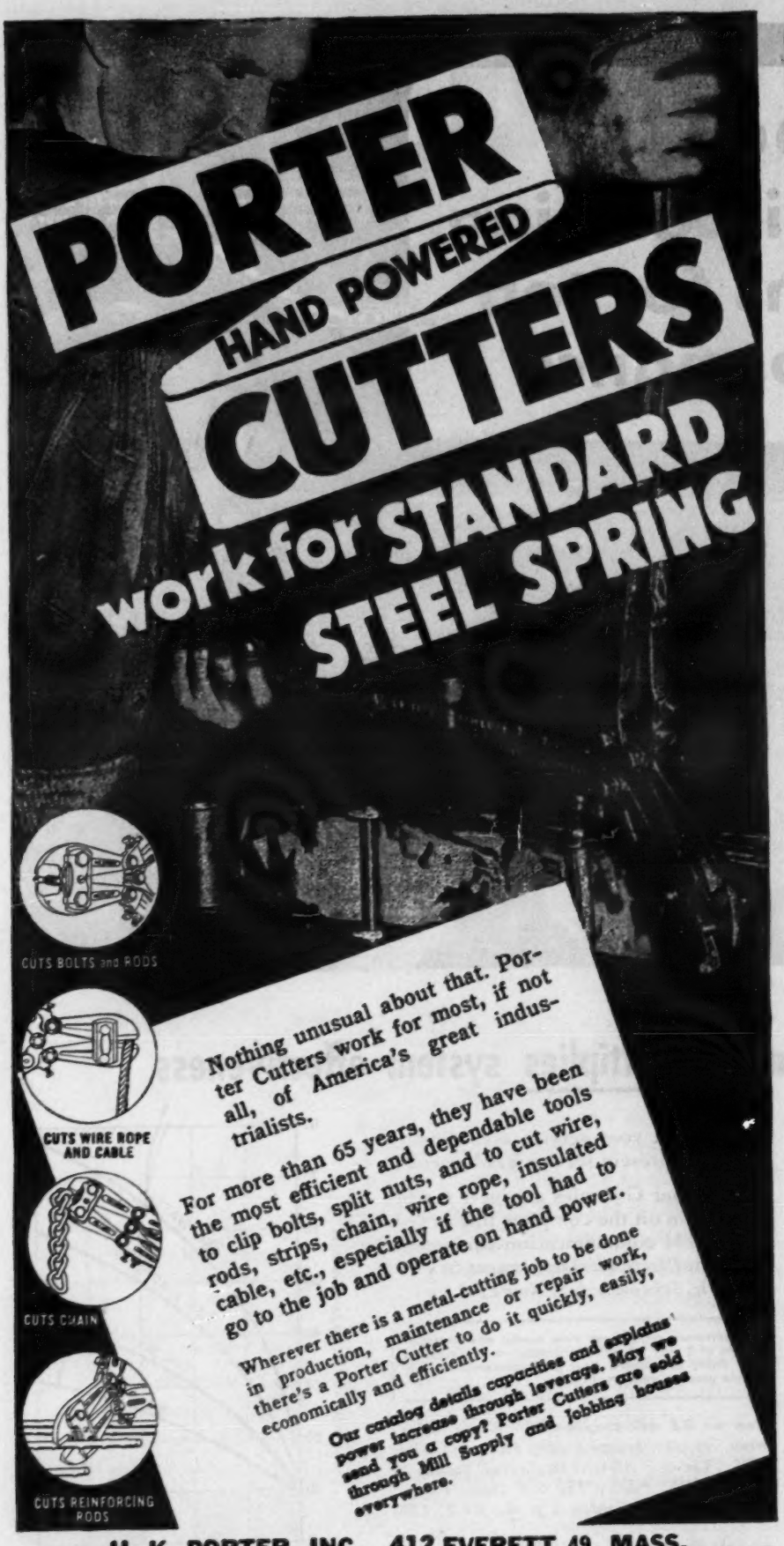
Effect of antenna height and location on communication ranges.

A applies to quiet residential and rural areas.
B applies to high noise-level locations, such as congested or industrial areas.
These curves are for estimating purposes only.

Everything for 2-Way Radio Communication

GENERAL ELECTRIC

163-D10-6916


PORTER
HAND POWERED
CUTTERS
work for STANDARD STEEL SPRING
CUTS BOLTS and RODS
CUTS WIRE ROPE AND CABLE
CUTS CHAIN
CUTS REINFORCING RODS
Nothing unusual about that. Porter Cutters work for most, if not all, of America's great industrialists.
For more than 65 years, they have been the most efficient and dependable tools to clip bolts, split nuts, and to cut wire, rods, strips, chain, wire rope, insulated cable, etc., especially if the tool had to go to the job and operate on hand power.
Wherever there is a metal-cutting job to be done in production, maintenance or repair work, there's a Porter Cutter to do it quickly, easily, economically and efficiently.
Our catalog details capacities and explains power increase through leverage. May we send you a copy? Porter Cutters are sold through Mill Supply and Jobbing houses everywhere.
H. K. PORTER, INC., 412 EVERETT 49, MASS.
PORTER HKP CUTTERS

OBITUARY

▶ JOSEPH W. HERMAN, electrical engineer for Burns and Roe, Inc., engineering consultants, New York, died on March 30 at the age of 62. Mr. Herman was born in Riga, Latvia. Coming to this country at a comparatively early age, he obtained his engineering education at Cooper Union, New York, and in 1905 started work with the General Electric Co. in the switchboard and station layout department. In 1907 he joined the New York Edison Co. as an electrical designer and worked in a similar capacity with Westinghouse, Church, Kerr & Co., Electric Bond & Share Co. and Pearson Engineering Co. Subsequent connections followed with Guggenheim Brothers, Stevens & Wood, Electric Management & Engineering Corp., and Gibbs & Hill. Mr. Herman became identified with Burns and Roe in 1936. He was a life member of the American Institute of Electrical Engineers.

▶ POLK LAFFOON, for many years an executive of the Cincinnati Gas & Electric Co., died on April 20 at his home near Covington, Ky. He had been in poor health prior to 1942, when he retired as vice-president and secretary of the Cincinnati utility. Since that time he continued as a director. Mr. Laffoon was born 68 years ago in Madisonville, Ky. He became secretary of the Kentucky State Tax Commission in 1900 and continued in that capacity until 1908, when he joined the then South Covington & Cincinnati Street Railway Co. in an executive capacity. Later he became an official of the Union Light, Heat & Power Co. and Cincinnati Gas.

▶ HANS N. BOETCHER, assistant to superintendent of power production stations department, Consolidated Gas Electric Light & Power Co. of Baltimore, died in that city on April 19 after a short illness. He was 47 years of age. A native of Hamburg, Germany, Mr. Boetcher received his education at the Technical University in Hanover. Prior to coming to this country in 1924 he was with the Siemens Electric Works, Hamburg. Continuing in the field of engineering associated with the generation of electric power, he entered the employ of Consolidated of Baltimore in 1925. Engaged primarily with the design, construction and operation of steam electric generating plants, Mr. Boetcher gave special attention in recent years to metallurgy as applied to the power industry. He was known as an authority on corrosion and failure of metals in power boilers and other power plant equipment, being the author of numerous papers and studies on these

Gulf Parvis Oil

reduces wear, cuts maintenance costs, helps insure top Diesel performance and long life

FOR OVER 15 YEARS Gulf Parvis Oil has been a leader in the fight against wear in Diesel engines. Ask users why they prefer Gulf Parvis Oil, and their answer is something like this: "It stands up and helps keep our maintenance costs down."

Superior lubricating and staying qualities of Gulf Parvis Oil are particularly important today—when outage is figured in the loss of vitally needed kw.-hrs., as well as dollars. Gulf Parvis Oil is helping many Diesel operators get more efficient and more dependable performance from their units.

If you are not one of the hundreds of enthusiastic users of Gulf Parvis Oil, it will pay you to investigate—call in a Gulf Lubrication Service Engineer and ask him to recommend the proper grade to fit your particular requirements. Write, wire, or phone your nearest Gulf office today.

GULF OIL CORPORATION · GULF REFINING COMPANY

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

GULF INDUSTRIAL LUBRICATION

BAKING BOMBS with

INFRA-RED

Here is a big practice bomb, dripping wet with paint. It's entering the Infra-Red tunnel in the Hammer-Bray Co., Oakland, California. In a matter of minutes that wet paint will be perfectly dry—dried by the magic, radiant heat, from Infra-Red Heat Lamps. Infra-Red is the fast new method of baking, drying, dehydrating—it's clean, uniform, fast and inexpensive! Investigate Infra-Red!

Wabash-Birdseye Infra-Red Heat Lamps

are standard for most infra-red tunnels, ovens, and other production line installations. In adapting your equipment to achieve the really dramatic results possible with Infra-Red, remember that Infra-Red heating is a science; and, for maximum efficiency, Wabash-Birdseye Lamps should be used with scientifically engineered equipment. We will gladly furnish names of manufacturers of such equipment.

WABASH APPLIANCE CORPORATION

345 Carroll St. Brooklyn 31, N. Y.

WABASH-BIRDSEYE

First in INFRA-RED

subjects. His knowledge of metals was also applied to welding, and his contributions in this field were outstanding. Mr. Boetcher served on numerous committees of the Edison Electric Institute, being a member of the prime movers committee at the time of his death. He also participated in committee work for the American Society of Mechanical Engineers and the American Society for Testing Materials and was active in the American Welding Society, having been prominent in the organization of the Maryland Section and at one time serving as local chairman.

► CHARLES E. WADDELL, consulting engineer and builder of various steam and hydraulic plants along the eastern seaboard, died in Asheville, N. C., on April 20 as the result of injuries suffered in an automobile accident the preceding day. He would have been 68 years of age on May 1. Dr. Waddell was consulting engineer for the George W. Vanderbilt estate at Biltmore, N. C. In previous years, he designed and built the North Carolina Electric Power Co.'s system, 1903-23; was consulting engineer, United Electric Securities Co., Boston, 1912; consulting engineer to the power section Council of National Defense, in surveying the power resources of the southern states for war emergency, 1917; consulting engineer for the Tennessee Valley Authority, 1936-38. He had served as director of conservation for the State of North Carolina and chairman and member of the North Carolina Board of Engineering Examiners. He was a fellow of the American Institute of Electrical Engineers, chairman of the North Carolina section, 1936; member of the American Society of Civil Engineers, (president North Carolina section, 1923-24); American Society of Mechanical Engineers, and the North Carolina Society Engineers (president, 1928).

► WILLIAM R. WEBSTER, chairman of the board of the Bridgeport Brass Co., Bridgeport, Conn., died of a heart attack in Philadelphia on April 28 in the Bellevue-Stratford Hotel. He was 77 years of age. A native of Oyster Bay, L. I., and a graduate of Cornell University, Mr. Webster was identified with Westinghouse, Church, Kerr & Co. early in his career. He had been with the Bridgeport Brass Co. from 1897 until his death, becoming chairman of the board in 1930.

► WILLIAM H. EMERY, who retired in 1942 as superintendent of the electric and gas plants of the Madison Gas & Electric Co., Madison, Wis., after 42 years of service, died on March 17 at the age of 74.

Here's An Air Power Team that's organized to win for you... Compressors, Rock Drills, Tools... Service... And Men Who Know Air Power

INGERSOLL-RAND AIR POWER

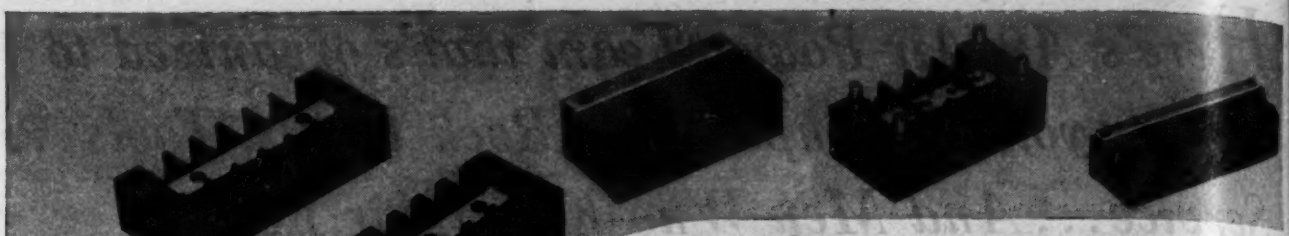
To make your air power — Mobil-Air Portable Compressors, sizes, 60 to 500 cfm for either gasoline or oil engine drive . . . also stationary compressors, electric, steam, oil engine, and belt-driven, up to 3000 hp and for all pressures.

Air Tools that increase your output — Jackhamers, Drifters, Wagon Drills, Jackbits, Paving Breakers, Clay Diggers, Back-Fill Tampers, Sump Pumps, Riveters, Hoists, etc.

COMPRESSORS • TURBO-BLOWERS • ROCK DRILLS • AIR TOOLS
CENTRIFUGAL PUMPS • CONDENSERS • OIL AND GAS ENGINES

Ingersoll-Rand

11 Broadway, New York 4, N. Y. 14-542



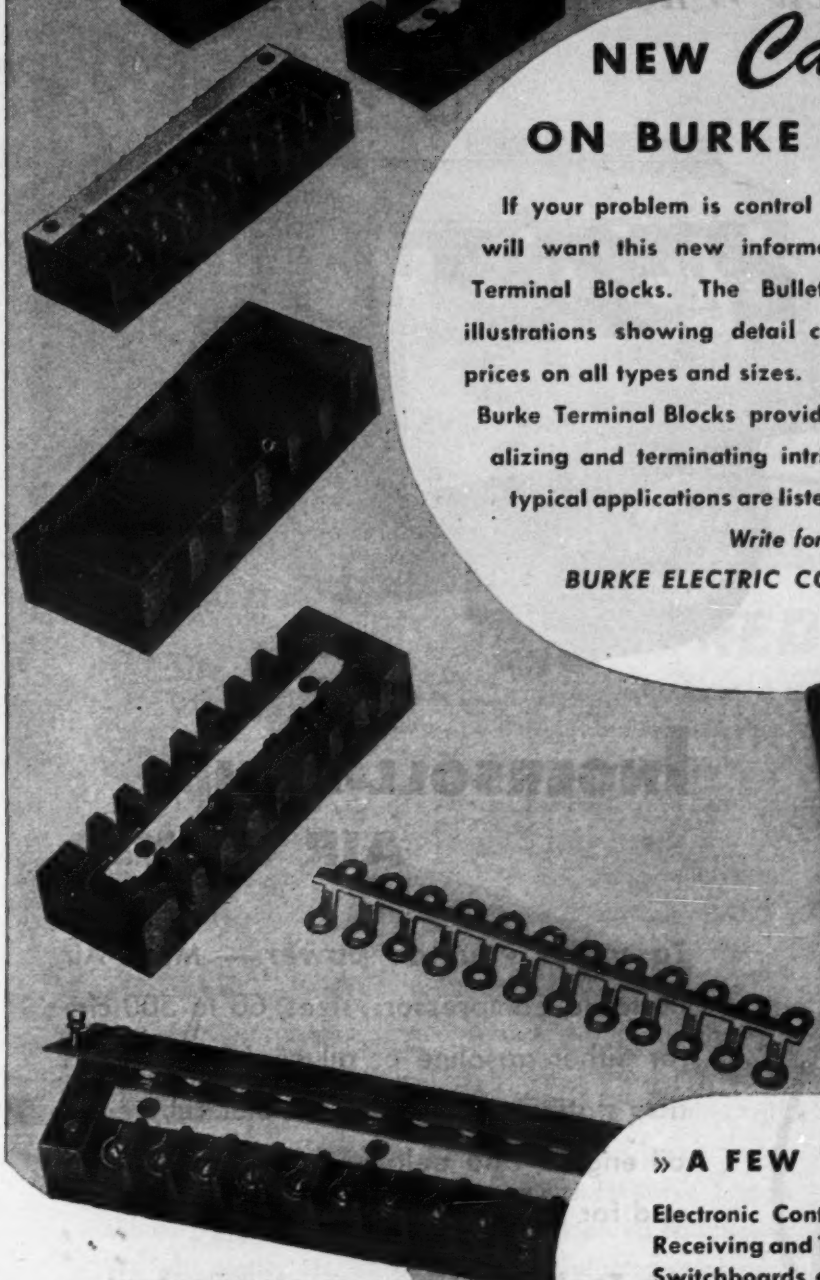
NEW *Catalog* AVAILABLE ON BURKE TERMINAL BLOCKS

If your problem is control circuit design, layout, or installation, you will want this new informative bulletin on Burke Molded Bakelite Terminal Blocks. The Bulletin contains actual size cross sectional illustrations showing detail construction features, with dimension and prices on all types and sizes.

Burke Terminal Blocks provide a simple method of identifying, sectionalizing and terminating intricate control circuit wiring—a few of the typical applications are listed below. Prompt deliveries are being made.

Write for your copy of booklet TB-3

BURKE ELECTRIC COMPANY • 155 W. 12th STREET • ERIE, PA.



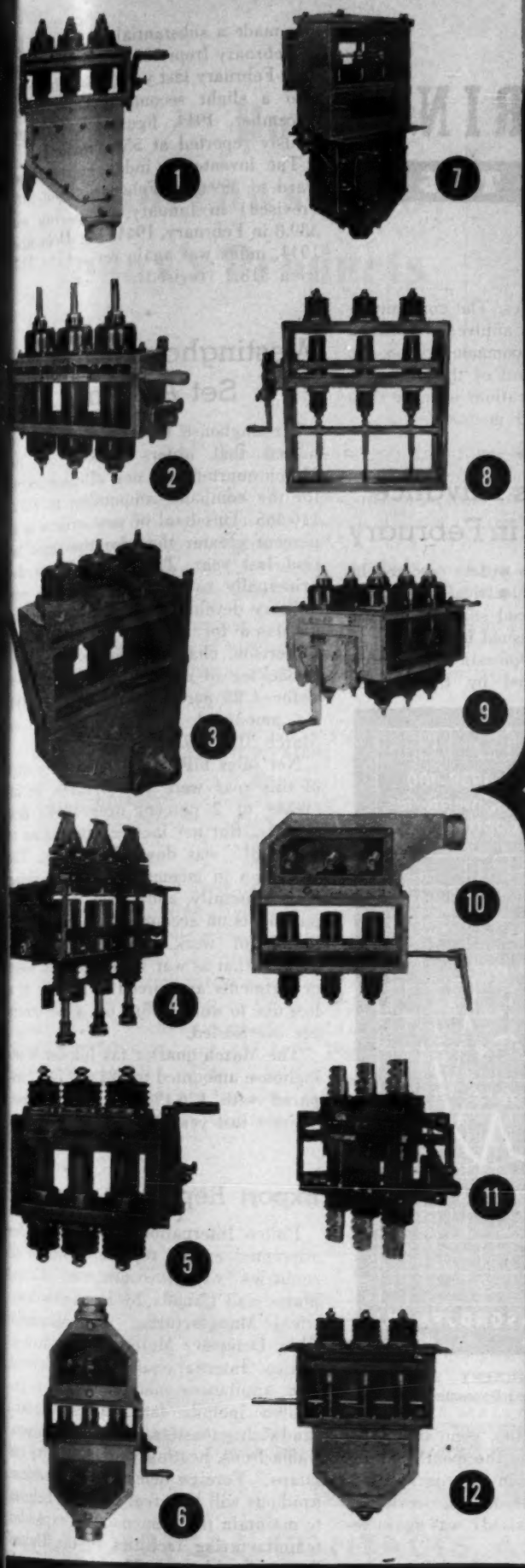
» A FEW *Typical* USES

Electronic Control Systems • Radar Equipment • Radio Receiving and Transmitting Sets • Telephone and Telegraph Switchboards • Load Dispatching Signal Systems • Fire and Police Signal Systems • Traffic Signal Systems Machine Tool Control • Voltage Regulator Equipment Switchboards of all kinds • Automatic Welding Control Induction Heating Control

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*



ELECTRICAL ENGINEERS EQUIPMENT CO. THREE & MELROSE PARK, ILL. U.S.A. THE MARK OF QUALITY

THE ISOLATOR LINE

OFFERS **many advantages over blade type disconnects. A few are enumerated herewith:**

Saves space in cubicles and bus structures

Saves steel in metal enclosed structures

Saves insulating barriers. The ISOLATOR provides its own

Saves bus supports. Buses may be carried on ISOLATOR bushings (See No. 4)

Saves auxiliary equipment when used as a CABLE ISOLATOR for safely disconnecting lead covered power cables (see Nos. 1, 3, 6, 7, 10, and 12)

Provides easy method for grounding (see Nos. 4 and 8)

The Load Interrupter ISOLATOR

The usefulness of the ISOLATOR is now further increased by the Load Interrupter ISOLATOR (see Nos. 2 and 7) which incorporates all the excellent features of the disconnect ISOLATOR, plus ability to open substantial loads and magnetizing currents.

If you have power installations necessitating the use of disconnecting switches you can do a better job with the ISOLATOR.

Send for Bulletin Nos. 135 and 138

ELECTRICAL ENGINEERS EQUIPMENT COMPANY

MELROSE PARK, ILL.

MANUFACTURING MARKETS

Fluorescent Lighting in 25% of Homes by '50

Fluorescent lighting which is now being used in one out of every ten homes will be used in one out of ever four homes wired for electricity by 1950, the twelfth anniversary of the introduction of fluorescent lighting.

A nationwide home lighting study prepared by an independent market research organization for Sylvania Electric Products, Inc., also revealed that in 1950 the industry will be selling at the annual rate of approximately 10,000,000 fluorescent lamps and about 3,500,000 fluorescent fixtures for residential use alone.

Of the one out of ten families now using some fluorescent lighting, half plan installations elsewhere in the house. Old and new customers alike put the kitchen first on the list for this type of lighting, want it in the bathroom and bedroom next. The majority hope to have permanent fixtures in all rooms; however, some plan on using portable fixtures while 20 percent will use both.

Of present users, 94 percent are satisfied. The chief complaint of the 6 percent of dissatisfied users was that the present fixtures are unattractive. The majority of installations was made because of the quality of light with economy of operation as the second factor.

Frank Mansfield, director of sales research for Sylvania, predicted that the sale of fluorescent lamps will not eat into the incandescent market for a long time after the war. "Sylvania believes that the total industry sale of incandescent lamps in the residential field will amount to 295,000,000 in 1946 and will reach 333,000,000 in 1949."

•

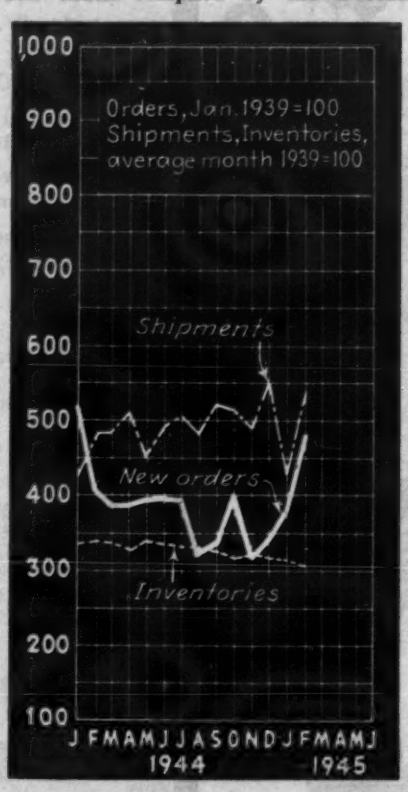
Celebrates Anniversary

Eisler Engineering Co. of Newark, N. J., is celebrating its 25th anniversary this year. In June, 1920, Charles Eisler founded the organization—a small plant employing only a few men—with the purpose of engaging in the design and manufacture of automatic machinery essential to the mass production of incandescent lamps, radio and electronic tubes and accessories. The company is celebrating its 25th anniversary with a special catalog, a commentary on the historical background of the organization, carrying illustrations of more than 4,000 machines and methods.

•

New Orders Advance Again in February

The value of new orders received by manufacturers of electrical machinery in February advanced sharply, according to the report issued by the Bureau of Foreign and Domestic Commerce. The index compiled by the Bureau moved upward to 480, compared with 384 (revised) during the month of January and with 406 in February, 1944. The December, 1944, figure, previously reported at 344 (revised) was again revised to 266.



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

Electrical machinery shipments index also made a substantial advance to [illegible] in February from 435 (revised) in January-February last year, 483. There was also a slight second revision in the December, 1944, figure—to 566, previously reported at 556 (revised).

The inventories index moved downward to 309.0 in February from 316 (revised) in January, comparing with 339.8 in February, 1944. The December, 1944, index was again revised, to 311 from 318.2 (revised).

•

Westinghouse Orders Set All-Time High

Westinghouse Electric Corp. has reported that orders booked for the March quarter set a new all-time record for the company, amounting to $312,116,465. This total of new orders is 36 percent greater than for the same period last year. The increase was due principally to demands for two new military developments which cannot be discussed for security reasons, A. W. Robertson, chairman, announced.

Backlog of unfilled orders has been reduced 23 percent since March, 1944. It amounted to $608,376,164 on March 31, 1945.

Net sales billed for the first quarter of this year were $194,371,393, an increase of 2 percent over 1944's first quarter. But net income, amounting to $4,007,815 was down 13 percent. The reduction in income was due to rising costs generally, and losses in some departments on account of unequal distribution of work. Mr. Robertson explained that as war work changes, some departments are forced to operate at a loss due to work falling off, while others are overloaded.

The March quarter tax bill for Westinghouse amounted to $24,609,741, compared with $26,193,269 for the same quarter last year.

•

Export Representative

Philco International Corp. has been appointed export representative in all countries except continental United States and Canada by Dominion Electrical Manufacturing Co., Mansfield, Ohio, Dempster McIntosh, president of Philco International, has announced. The appliances manufactured by Dominion include fans, irons, toasters, sandwich toasters, heaters, mixers, waffle irons, heating pads and infra-red lamps. Foreign demand for American products will be a real factor in helping to maintain the tremendously expanded manufacturing facilities in the United States after the war, Mr. McIntosh said.

Building Tomorrows into Today's Products

IF George Washington could have owned a modern electric refrigerator, it might not be a museum piece today. Judging by performance tests of Mallory contacts for refrigerator motors, 194x's electric refrigerator could have cooled the drinks and preserved the food of George Washington and be capable of performing the same service for today's guests at Mt. Vernon.

Taking nothing for granted, a refrigerator manufacturer put Mallory, silver-faced steel-backed, standard SUR 32 contacts to the following accelerated test—and translated service life into years of use.

TEST	OPERATION CYCLES	HOUSEHOLD SERVICE EQUIVALENT	CONDITION OF CONTACTS
#1	1,556,000	85 years	Good
#2	2,134,000	171 years	Good
#3	3,075,000	168 years	Good
#4	3,230,000	177 years	Good
#5	3,277,000	180 years	Good

Mallory contacts are used on refrigerator motors to cut out the starting winding after full motor speed is obtained. Under adverse conditions, a refrigerator motor goes through fifty such operations in twenty-four hours. Speeding up the time interval to 512 operations per hour on five motors, running at 1750 R. P. M., it was demonstrated that Mallory contacts could operate perfectly for 85 to 180 years and *still be in good condition.* This again is indicative of the built-in quality of Mallory contacts which assures faultless service from standard contacts engineered to out-live the product for which they were designed.

MALLORY STANDARDIZED CONTACTS

Silver-Faced
STEEL-BACKED

TYPE SUF TYPE SUR TYPE SVF TYPE SVR

These Mallory contacts are manufactured by a patented process which bonds the silver face directly to the steel back . . . carry higher current without overheating. Steel backs are nickel plated to resist corrosion. Write today for factual information on Mallory contact and contact assemblies available in standard sizes.

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

P. R. MALLORY & CO. Inc.
MALLORY

ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES

THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM . . .

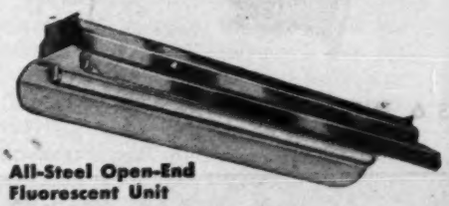
Scraping Dept. Gould & Eberhardt, Inc., Irvington, N.J.

"Day Shift" production around the clock!

When you give workers *Skilled Lighting* . . . the product of Wheeler's advanced engineering . . . you improve morale, bring daylight speed and accuracy to the job 24 hours a day!

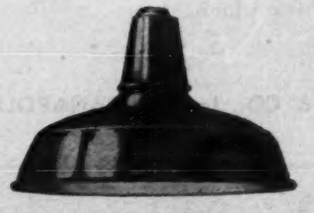
That's one big reason why it's important to install Wheeler Reflectors – product of 64 years of specialized light engineering. Wheeler Units are engineered to provide maximum light from standard lamps. Their high reflection factor puts light to work where it belongs – on the job. Made of heavy gauge metal, coated with vitreous enamel, their rugged construction insures long service, easy maintenance.

Learn how these better-engineered units can bring *Skilled Lighting* to your production scheme. Send for catalogs showing complete line of incandescent and fluorescent fixtures. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** Also New York. Representatives in principal cities.



All-Steel Open-End Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuou runs.



RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Distributed Exclusively Through Electrical Wholesalers

Wheeler Skilled Lighting REFLECTORS

Made by Specialists in Lighting Equipment Since 1881

Blaw-Knox Shipments Up; Buys New Un

Shipments for the first quarter 1945 were about double those for t similar 1944 period, William P. Wi erow, president, Blaw-Knox Co., a nounced at the recent annual meeting Camden, N. J. Some portion of this i crease, Mr. Witherow said, is due to t production of 40 mm. anti-aircraft gu at the Special Ordnance Division pla at York, Pa., managed and operated f the Navy since last June.

He stated that since the inception the war program, production of t company has totaled close to $400,00 000. Mr. Witherow explained that c backs in some war contracts are e pected to occur from time to time, a that while current operations are t highest yet attained by the compan shipments for the remaining quarters the year will depend upon requirement for the prosecution of the war and t extent to which reconversion may b come effective.

Blaw-Knox has recently purchase the plant, inventory and uncomplete contracts of the Buffalo Foundry & Ma chine Co. of Buffalo, manufacturer equipment for the food industry, pro ess and chemical plants. The newly a quired property will be known as t Buflovak Equipment Division of Bla Knox. No changes will be made in ma agement or personnel, it was stated.

•

1945 Range Authorizations Now Exceed 100,000 Mar

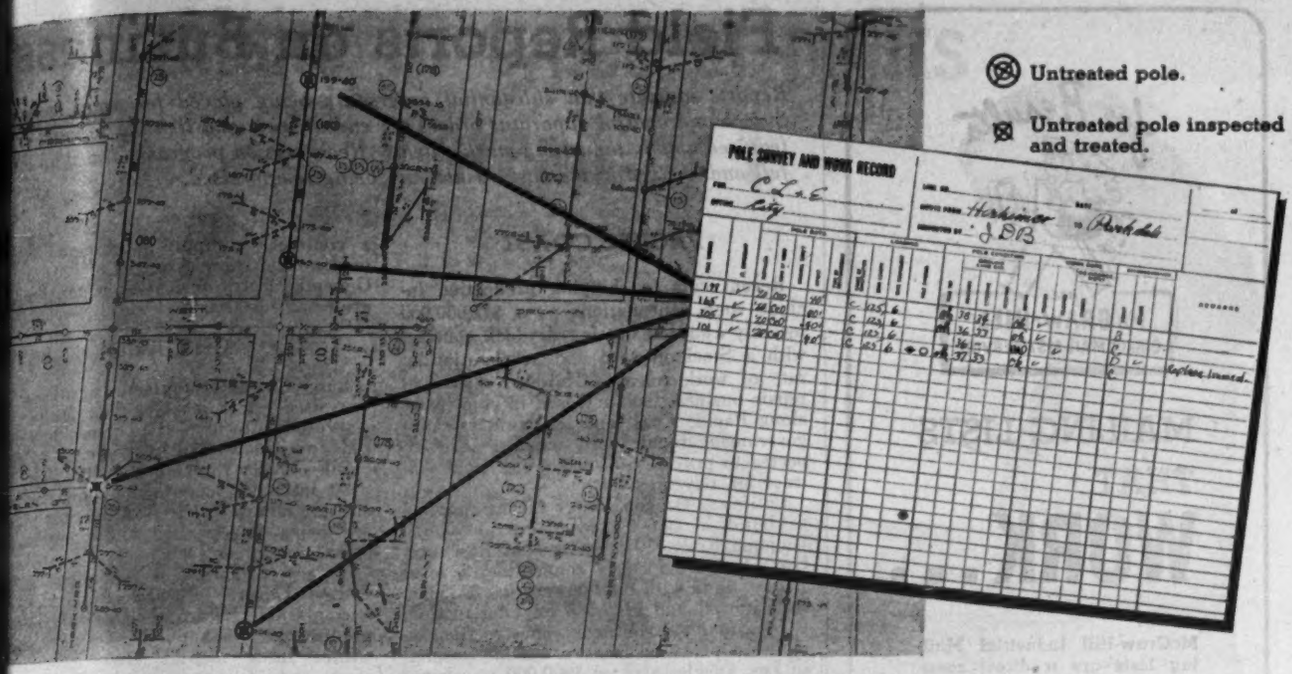
Production of 57,816 additional d mestic electric ranges during the se ond, third and fourth quarters of 19 has been approved by the War Produ tion Board. Production of 42,237 rang for the first and second quarters ha already been authorized. WPB plans production of 140,000 ranges in 19 and has already authorized 100,053.

All of the ranges are to have aut matic temperature controls but no ti ers; they may have lamp installatio only if the manufacturer has them stock.

•

Elects Three Directors

Announcement has been made of t election of three new directors to t board of Foster Wheeler Corp. Each the new directors has been associate with the corporation for several yea They include: William L. Martwic vice-president in charge of gener sales; Lee A. Swem, patent counse and Charles E. McCulloch, manager the petroleum refinery division.



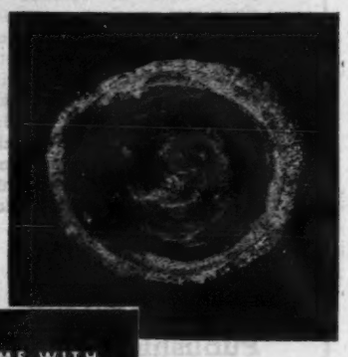
How One Leading Utility makes

INSPECTION TIME PROTECTION TIME *with* OSMOPLASTIC

Reproduced above are the basic records employed by a large electric utility to accurately control the maintenance of standing poles in their overhead distribution system.

Under this system, every pole is numbered and mapped. A glance at the map shows the condition of all poles in the area covered . . . symbols indicating whether they are treated or untreated. Filed with the map, is a pole inspection record giving detailed information on the poles which need treating, plus the data on those which have been inspected and treated. Thus does one utility intelligently MAKE INSPECTION TIME PROTECTION TIME with OSMOPLASTIC.

We are equipped to handle your groundline treating with Osmoplastic on a contract arrangement with our own supervised crews, or we can furnish Osmoplastic for your own application. Record systems as described above are available. Write for complete information, technical data and prices.



The white outer area of this pole cross-section, cut at groundline, shows the deep penetrating action of the toxic chemicals in Osmoplastic.

MAKE INSPECTION TIME, PROTECTION TIME WITH

OSMOPLASTIC

MANUFACTURED BY

OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.

GENERAL OFFICES: BUFFALO 12, N. Y.

BRANCH AND SALES OFFICES: BIRMINGHAM 3, ALA.; DENVER 2, COLO.; NEW YORK 7, N. Y.; KENOVA, W. VA.; HARLAN, KY.; CHICAGO 4, ILL.

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Make 10 types of prints instead of 1

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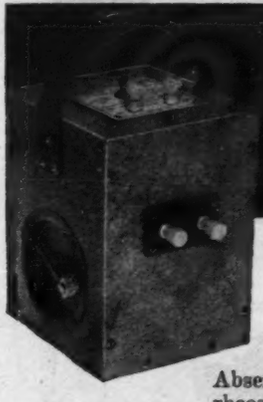

Announcing a Three-Way CIRCUIT TESTER

GIVES QUICK "YES" OR "NO" ANSWERS

Built to withstand rough treatment . . . Simplifies acceptance testing of residential and commercial wiring.

Absence of commutators, slip rings, calibrated meters, rheostats or adjustment knobs in this compact circuit tester, simplifies both operation and maintenance . . . makes it cost less than conventional circuit testers. The self-contained generator develops peaks of 250 V.A.C. and tends to assure uniform tests regardless of generator speed. It requires but one operator and minimum instruction. Why not get the complete story? Write for details today.

DOES ALL THREE JOBS

✓ *Audible Check:*

1. Tests wire and ground insulation
2. Tests continuity of wires

✓ *Visual Check:*

3. Determines polarity of wires*

**A special indicator attachment is available for polarity tests.*

CONNECTICUT TELEPHONE & ELECTRIC DIVISION

GREAT AMERICAN INDUSTRIES, INC.

MERIDEN CONNECTICUT

Motor Industry Prepared for Civilian Productio

Only a minimum of re-tooling wil necessary to allow manufacturers o tegral horsepower electric motors meet demands for these motors civilian production once manpower materials are available, industry rep sentatives told WPB recently.

Layoffs in the industry are not ticipated, WPB was told, and inste the industry expects to be able to sorb an additional 15 to 25 percen its present manpower as soon as wo ers are available. Increased export bu ness and the resumption of dome programs are expected to offset backs in military demands.

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WPB Authorizes 522,144 Irons for Second Quart

The production of 522,144 elec irons in the second quarter of 1945 h been authorized by the War Produc Board. First quarter authorizations talled 521,385. Of the 33 manufactur who received authorizations, the le ing ones are General Electric Ontario, Calif., 119,000; Majestic El tric Appliance Co., Galion, Ohio, 7 158; Knapp-Monarch Co., Dover, Oh 50,422; Chicago Flexible Shaft C 42,015; Proctor Electric Co., Philad phia, 36,373; Verplex, Essex, Con 25,000.

•

Army-Navy "E" Awards

Among the recent recipients of Army-Navy "E" award are the follo ing: Reliance Electric & Engineer Co., Cleveland, two renewals—fi starred Army-Navy "E" and two-star Maritime "M"; Westinghouse Elec Corp., elevator division, Jersey C N. J., sixth "E" pennant; Westinghou home radio division, Sunbury, P Walter Kidde & Co., Inc., main plant Belleville, N. J.; General Electric Fort Edward, N. J., plant; Anso Electrical Co., Ansonia, Conn., renew U. S. Rubber Co., Passaic, N. J., pla Edwards & Co., Norwalk, Conn., fou renewal "M" award.

•

Plans Management Cours

A management course will be offe by the State University of Iowa, Io City, from June 11 to 29. The course designed for those in industry who w comprehensive training in producti planning, plant layout, motion and ti study, wage incentives, and rela subjects.

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Provides a

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Sales Opportunities

FLORIDA—War Department, Washington, D. C., has authorized expansion at Eglin Airfield, including shops, hangar and other structures, with electrical and mechanical equipment. Also extensions in power substation, distribution lines, service connections and other electrical facilities, including installation of lighting system for new runway and taxiway. Entire project will cost about $5,000,000 and will be carried out under direction of U. S. District Engineer Office, Mobile, Ala.

MINNESOTA—Municipal Light and Power Department, Litchfield, has authorized surveys and estimates of cost for proposed expansion in steam-electric generating station, with installation of equipment and facilities for increased output. Program will be carried out as a post-war development. Pfeifer & Shultz, Wesley Temple Bldg., Minneapolis, are consulting engineers.

CALIFORNIA — General Motors Corp., Southern California Division, 704 West Olympic Blvd., Los Angeles, has secured approval of WPB for reconversion of large plant for automobile assembling. Plant initially was converted for military tank production and later, aircraft assembling; it has been inactive for several months. New program will include installation of tools, machinery, electrical equipment and other facilities. Cost estimated over $1,200,000. Proposed to begin work soon.

TEXAS—Rheem Mfg. Co., 1401 Lockwood Dr., Houston, steel barrels, tanks, drums, etc., plans main power substation and several transformer stations in connection with expansion in local plant for shell manufacture for government. Also power distribution system, lighting system and other electrical facilities. Entire project will cost about $3,000,000, with financing by Defense Plant Corporation. Power supply will be furnished by Houston Lighting & Power Co., Houston, Texas, R. W. Foster is chief engineer for Rheem company.

KANSAS — Board of Public Utilities, Kansas City, has authorized further expansion in Quindaro steam-electric generating station, with installation of new boiler unit and accessories, with capacity of 200,000 lb. steam per hr. Cost estimated close to $600,000. It is understood that application will be made for a priority rating. Burns & McDonnell Engineering Co., 107 West Linwood Blvd., Kansas City, Mo., is consulting engineer.

PENNSYLVANIA—Consolidated Vultee Aircraft Corp., Allentown, will carry out extensions in local works for production for Navy Department, with installation of machinery and electrical equipment. Cost estimated about $300,000. Financing by Defense Plant Corporation. Work will be placed under way soon.

VIRGINIA—Bureau of Ordnance, Navy Department, Washington, D. C., plans extensions in power plant at naval air depot at St. Julien's Creek, including installation of new 150-hp. boiler and accessories, and conversion of existing boiler to oil-fired unit. Cost estimated at $118,000. Appropriation is being arranged in budget for coming federal fiscal year, beginning July 1. Bureau of Yards and Docks, Navy Department, Washington, will be in charge.

NEW YORK—Ansco, Inc., Binghamton, photographic papers, films, etc., plans new

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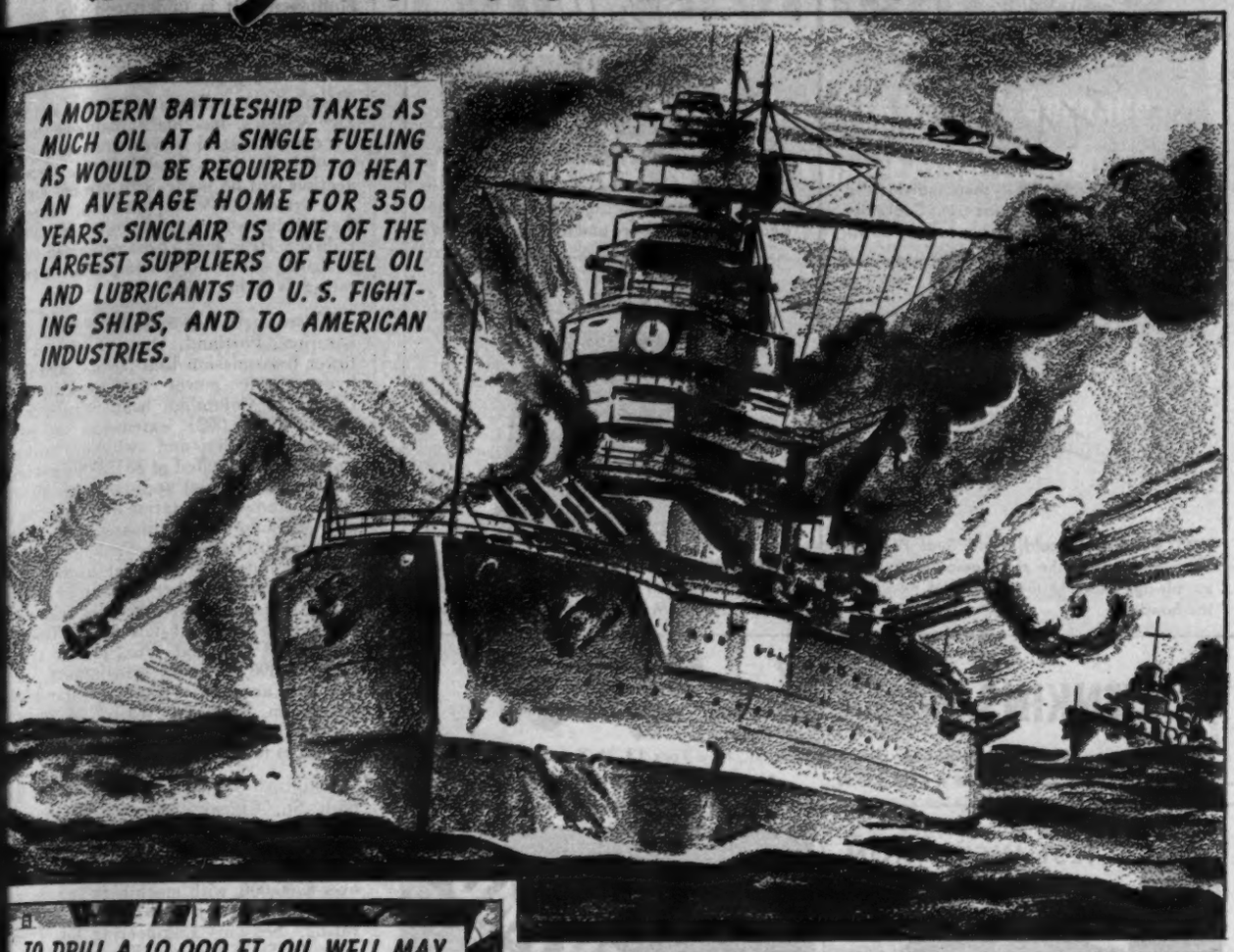

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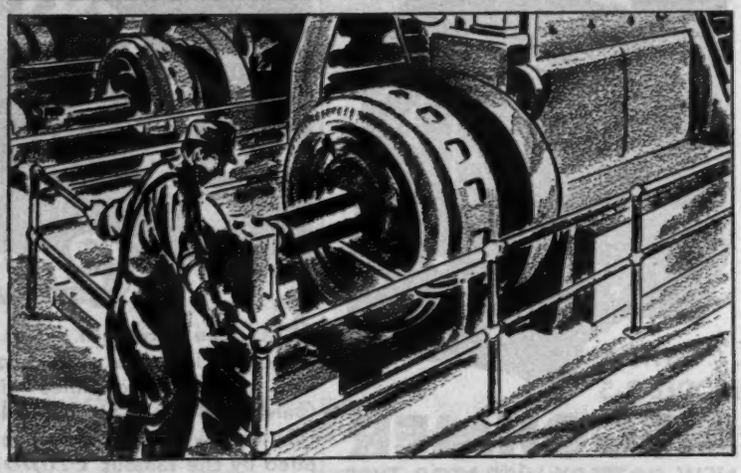

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electric power plant on tract of land in vicinity of plant, recently acquired, estimated to cost approximately $750,000, with turbine-generator, boiler and auxiliary equipment. It is understood that this will be a post-war project. Company is a subsidiary of General Aniline & Film Corp., 230 Park Ave., New York.

CALIFORNIA—Bureau of Power and Light, Los Angeles, has plans maturing for new 132,000-volt steel tower transmission line on 98th St., from Avalon Blvd., where connection will be made with present high-tension system, to Van Ness Ave., where service will be delivered to power substation in Baldwin Hills area. Cost estimated close to $190,000, exclusive of equipment. A priority rating is being secured.

WASHINGTON—Bonneville Power Administration, Portland, Ore., plans new steel tower transmission line from Grand Coulee hydroelectric power development, Grand Coulee to Columbia, near Seattle, to cost about $1,925,000; extensions in present power substation and switching station at Columbia, estimated at $615,000; new transmission line to cost approximately $860,000, and new power substation and switching station at Snohomish, estimated at $1,566,000. Appropriations will be included in forthcoming budget for federal fiscal year beginning July 1. Other work to be arranged for in same budget includes addition to present power substation at Troutdale, vicinity of Portland, Ore., to cost approximately $890,000, with transformers, switchgear and accessories; and new transmission line from Potlatch, Wash., to Fairmont, Ore., estimated at $761,000, and power substation at latter place to cost about $679,000.

ILLINOIS—Johnson & Johnson, 4949 West 65th St., Chicago, surgical dressing and supplies, pharmaceutical products, plans new one-story plant at Elgin, totaling about 200,000 sq. ft. floor space. Cost reported over $700,000, with machinery and electrical equipment. Project will have a priority rating. Sessions Engineering Co., 1 North LaSalle St., Chicago. Executive offices of company are at New Brunswick, N. J.

MINNESOTA—City Council, Crookston, is considering new municipal light and power plant, including electrical distribution system and facilities. Toltz, King & Day, Inc., Pioneer Bldg., St. Paul, consulting engineer, has been engaged to make surveys and estimates of cost.

CALIFORNIA—War Department, Washington, D. C., has authorized construction of postal concentration center No. 2 at army base, Oakland, including new building of about 300,000 sq. ft. floor space, with mechanical and electrical equipment. Also street-lighting system and other facilities. Cost estimated at $2,000,000. Proposed to begin work soon. Project will be supervised by U. S. District Engineer Office, San Francisco.

WASHINGTON—Puget Sound Power & Light Co., Seattle, has secured a 25-year franchise for new transmission line on Whidbey Island Hy., Island County, for which application was made a number of weeks ago, and plans to begin work at early date.

TENNESSEE—North American Rayon Corp., Elizabethton, plans expansion in mill for production of high tenacity rayon for tire cord service for WPB, with installation of machinery and electrical equipment for sizable capacity. Cost estimated about $380,000, with financing by Defense Plant Corporation. Work is scheduled to begin at early date.

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. . . . which means that STANDARD Sprague Koolohms now have the same EXTRA HUMIDITY PROTECTION formerly obtainable only on special order.

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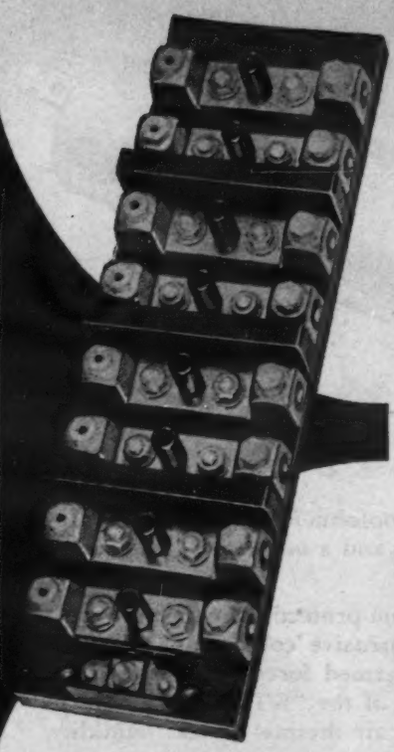

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Recent Legislation

FLORIDA—Opposition is expected in the Legislature to Governor Millard Caldwell's tax proposal boosting the 1½ percent levy on gross receipts of all public utilities to 10 percent. The proposal covers all utilities, including privately and municipally owned, as well as cooperatively owned power systems. A bill has been introduced in the House which would set up a five-member electric utility board to supervise electric, gas and water companies—both privately and publicly owned. The members would receive salaries of $3,600 annually. Another measure would increase the present State Railroad Commission from three to five members, change the name to the "Florida Public Service Commission" and broaden its powers. Commissioners would receive salaries of $7,500 a year.

MASSACHUSETTS—The bill which would have barred public utility companies from selling electric and gas appliances has been defeated in the House by a vote of 122 to 94.

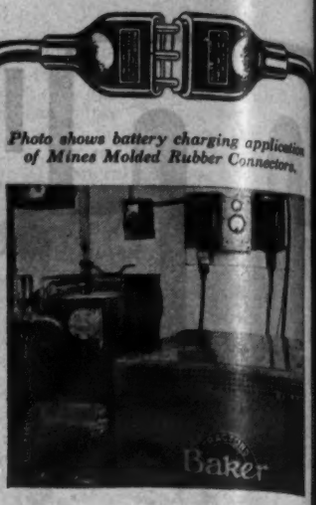
OHIO—By a vote of 111 to 12, the House passed and sent to the Senate the bill to extend for another two years the 0.65 percent utility excise tax, which expired April 30. The utility tax produces approximately $2,400,000 a year. Proceeds are distributed to local governments. In the past the money has been earmarked for poor relief, but the bill recently passed by the House was amended to permit the diversion to county soldier and sailor relief funds of any current proceeds of the tax which are not needed for poor relief.

Recent Rate Changes

SOUTH CAROLINA POWER CO., Charleston, will put into effect on June 1 a new rate schedule, which will save customers $233,500 annually. The greater part of the new reductions will accrue to the commercial customers, but residential consumers using less than 65 kw.-hr. a month will also benefit.

NEW JERSEY POWER & LIGHT CO., Dover, has been ordered by the Board of Public Utility Commissioners of New Jersey to file rate schedules to effect a reduction of $306,000 in the electric revenue of the company. The order is a result of the hearing held on April 19 to consider the results of the first year of operation of New Jersey Power under the rate adjustment plan adopted in March, 1944. This reduction is in addition to a billing credit or customer dividend of $129,000 extended to all residential and commercial customers in December, 1944. According to H. C. Thuerk, president of New Jersey Power & Light, the company is filing new rate schedules in compliance with the board's order, which will effect the required reduction. The new schedules are intended to bring about a more equitable relationship in the charges made for the various classes of electric service. They provide for a reduction in residential service revenue of approximately $159,000, including a billing credit of $102,000 to be extended to all residential customers later in 1945, a reduction in commercial revenue of approximately $47,000 per annum and industrial revenue of approximately $95,000 per annum.

MOUNTAIN STATES POWER CO. has made rate reductions, amounting to five percent for all types of service for approximately 57,000 customers in the Lander, Riverton



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Mines Water-Seal Connectors are available in single conductor and multi-conductor types.

Our engineers will gladly work with you in solving portable power transmission problems on capacities up to 5000 volts and 325 amps.

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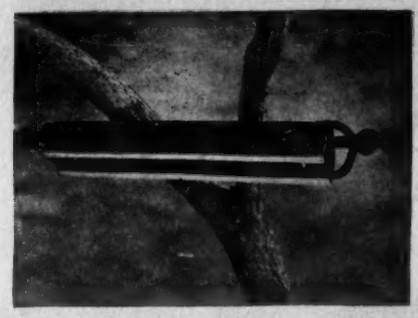
TREES



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and Big Horn Basin areas near Casper, Wyo. New rate schedules, as filed with the Wyoming State Public Service Commission by the Casper division of the utility, will save customers about $28,000 annually. Reductions followed lowering by the Bureau of Reclamation of the cost of power delivered to the utility from the Shoshone power plant and a pilot plant on the Riverton reclamation project in Wyoming, it was reported.

MONTANA-DAKOTA UTILITIES CO. customers in Montana will realize savings of about $110,000 annually as the result of a new rate schedule for the company approved recently by the Montana Railroad and Public Service Commission and effective May 1. Reductions amount to 20 percent for residence rates, 18 percent for commercial rates and 15 percent for industrial power rates.

BOWLING GREEN, KY., received the benefit of a 27 percent reduction in electric rates when TVA standard rates were applied to April billings. Consumers will save $85,000 annually under the new schedule. Residential rates were cut 24 percent, commercial 30 percent, industrial 29 percent, and City street-lighting 26 percent. Electric rates in Bowling Green were reduced 20 percent when the city acquired TVA service in 1942.

KAUKAUNA, WIS., electrical department's rate reduction totaling $30,000 annually, has been approved by the state Public Service Commission. The reduction will affect residential, commercial and industrial customers.

•

REA Funds Allotted; Contracts Approved

The Rural Electrification Administration recently approved allotments totaling $533,000 to 16 rural cooperatives in 13 states. The main part of these funds will be used for extension of electric service to farms located near existing lines. No construction will be undertaken which does not meet with WPB approval.

This brings total REA allotments to $523,581,544, of which $29,981,550 represents operations during the current fiscal year.

Details are as follows:

ALABAMA—Tallapoosa River Electric Cooperative, Inc., Lafayette, $60,000.

INDIANA—Old Capital Electric Refrigeration Membership Corp., Corydon, $40,000, for construction of refrigerated locker plant.

IOWA—Humboldt County Rural Electric Cooperative, Humboldt, $15,000.

LOUISIANA—Dixie Electric Membership Corp., Zachary, $15,000.

MISSOURI—Scott-New Madrid-Mississippi Cooperative Assn., Sikeston, $10,000.

NEW MEXICO—Otero County Electric Cooperative, Inc., Cloudcroft, $5,000.

NORTH CAROLINA—Pitt & Greene Electric Membership Corp., Farmville, $30,000; Union Electric Membership Corp., Monroe, $25,000.

OHIO—Washington Electric Cooperative, Inc., Marietta, $30,000.

OKLAHOMA—Southwest Rural Electric Assn., Inc., Tipton, $40,000.

SOUTH CAROLINA—Lynches River Electric Cooperative, Pageland, $20,000.

TENNESSEE—Gibson County Electric

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• The automatic guard adds immeasurably to the safety of this pole—the point is covered when not in use—completely guarded against damage. When in use, the tubular sleeve slides back and reenforces the head, adding to the service life of the pole.

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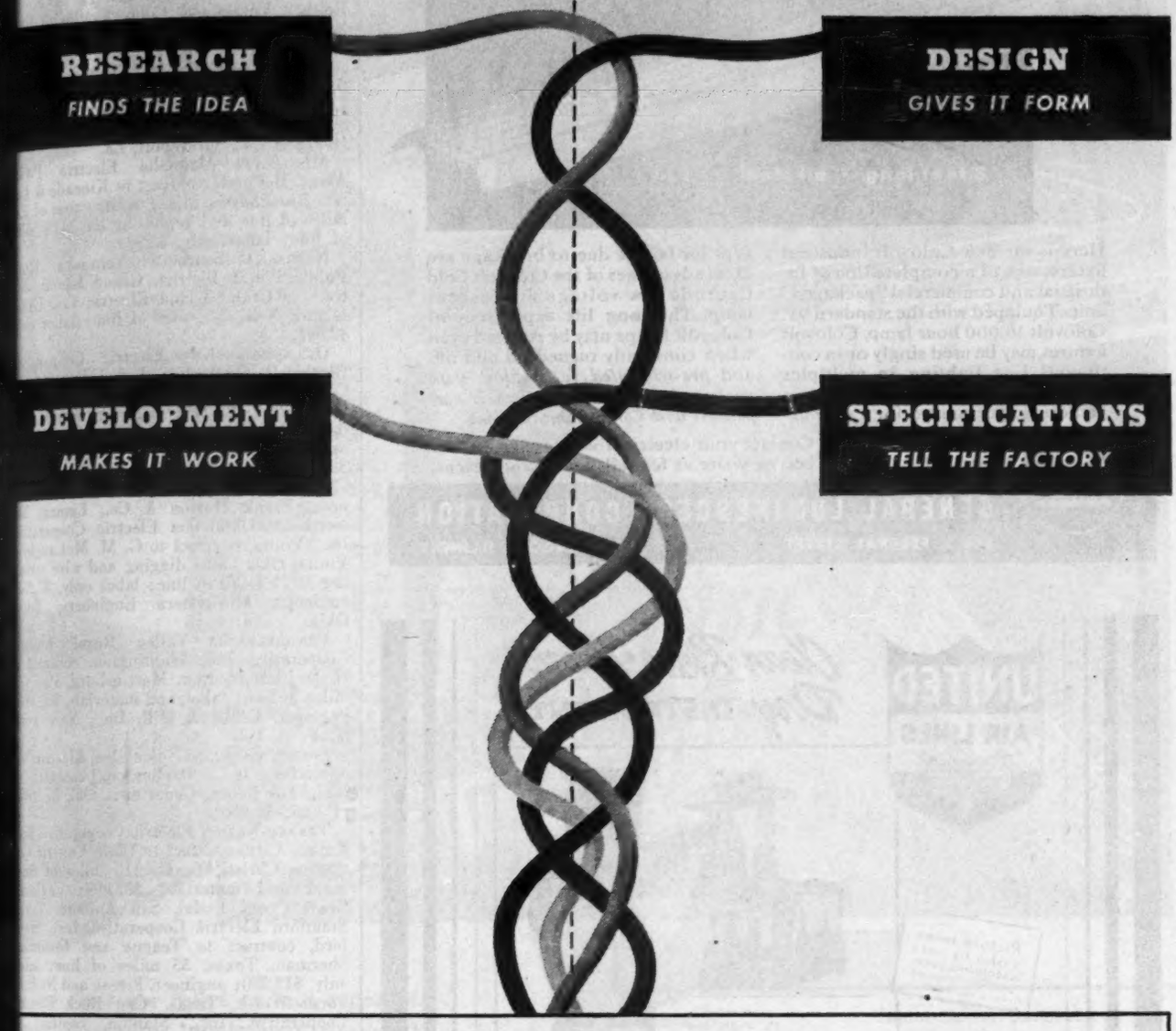

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brings together the efforts of 2000 specialists in telephone and radio communication. Their wartime work has produced more than 1000 projects for the Armed Forces, ranging from carrier telephone systems, packaged for the battle-front, to the electrical gun director which helped shoot down robots above the White Cliffs of Dover. In normal times, Bell Laboratories' work in the Bell System is to insure continuous improvement and economies in telephone service.

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Halls, $50,000.

TEXAS—Victoria County Electric Co
erative Co., Victoria, $10,000; North Pl
Electric Cooperative, Inc., Perryton, $50,0

WASHINGTON—Public Utility District
1 of Douglas County, Waterville, $33,000

Construction Contracts Approved

COLORADO—Intermountain Rural Elec
Association, Littleton, contract to E.
Reither, Englewood, Colo., 4 miles of l
labor only, $1,427; engineer, Glenn
Fickel, Denver, Colo.

LOUISIANA—Claiborne Electric Coop
tive, Inc., Homer, contract to Stuart C. H
Co., Jackson, Miss., 125 miles of line; l
and materials, $86,706; engineer, Geo.
Hengy & Co., Shreveport, La.

MISSISSIPPI—Magnolia Electric Pow
Assn., McComb, contract to Kincade & L
ton, Brookhaven, Miss., construction of 2
miles of line and rephasing on 28.85 m
of line; labor only, $5,908.

NEBRASKA—Southern Nebraska Rur
Public Power District, Grand Island, c
tract to Grand Island Electric Co., Gra
Island, Neb., 3½ miles of line; labor on
$2,643.

OKLAHOMA—Kay Electric Cooperati
Blackwell, contract to J & J Construc
Co., Oklahoma City, Okla., 65 miles of li
labor only, $22,245; engineer, Frank Ho
ton & Co., Lamar, Mo. Indian Electric C
operative, Inc., Cleveland, contract to M
Sorley Construction Co., Cleveland, Okla
72 miles of line; labor only, $16,692; en
neer, Frank Horton & Co., Lamar, M
Northeast Oklahoma Electric Cooperati
Inc., Vinita, contract to G. M. McLaugh
Vinita, Okla., hole digging and wire strin
ing of 71 miles of line; labor only, $7,25
engineer, Midwestern Engineers, Tul
Okla.

PENNSYLVANIA—Valley Rural Electri
Cooperative, Inc., Huntington, contract
H. D. Blattenberger, Martinsburg, Pa., C
miles of line; labor and materials, $59,90
engineer, Gibbs & Hill, Inc., New Yo
N. Y.

SOUTH CAROLINA—Pee Dee Electric C
operative, Inc., Darlington, contract
Wright & Lopez, Cedartown, Ga., 8½ mi
of line; $2,980.

TEXAS—Karnes Electric Cooperative, In
Karnes City, contract to Lowe Electric C
Corpus Christi, Texas, 112 miles of lin
labor and materials, $82,899; engine
Beavers and Lodal, San Antonio, Tex
Stamford Electric Cooperative, Inc., Sta
ford, contract to Teague and Goodm
Sherman, Texas, 55 miles of line; lab
only, $13,280; engineer, Freese and Nichol
Forth Worth, Texas. Cap Rock Electri
Cooperative, Inc., Stanton, contract
Eugene Ashe Electric Co., Forth Wor
Texas, 100 miles of line; labor and ma
rials, $72,647; engineer, H. N. Rober
Lubbock, Texas.

Ohio Substation Approved

The Office of War Utilities' Pow
Division has authorized Ohio Edison C
to build a 45,000-60,000-kva. substati
at Barberton, Ohio, with two 138-k
circuits and two and one-half miles
138-kv. line connecting the substati
with the Cleveland-Akron circuit.

Also approved was coal-handli
equipment, valued at about $170,00
for the Rockford plant of the Centr
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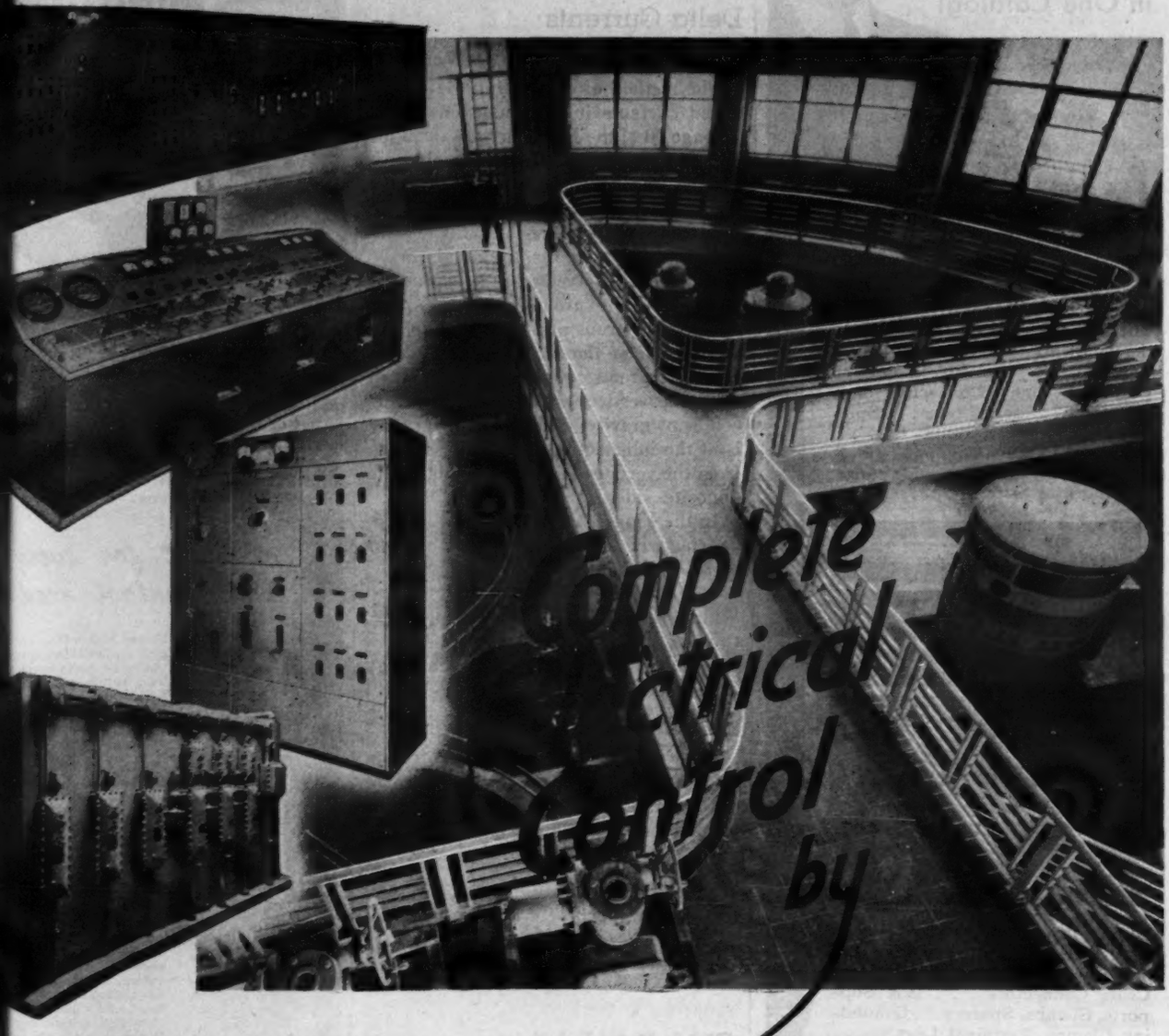
FOUR of the 18 METROPOLITAN SWITCHBOARDS IN THE JAMAICA SEWAGE DISPOSAL PLANT



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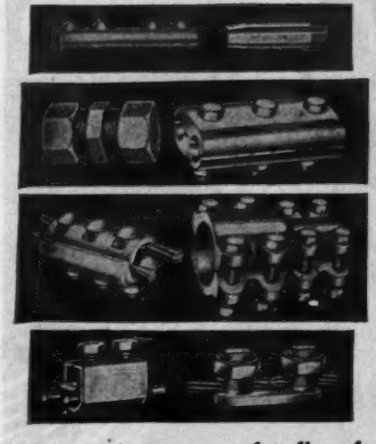

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LETTERS TO THE EDITOR

Delta Currents

To the Editor of ELECTRICAL WORLD:

The method of calculating the unbalanced currents in Δ connections given on page 90 of the ELECTRICAL WORLD for March 31, 1945, is incorrect, since it assumes that the unbalanced Δ-currents are 120 degrees apart in phase. If the transformers are alike this is true only when the line currents are equal.

In general the vector sum of the impedance drops around the Δ equals zero. If the transformers are alike, the vector sum of the currents equals zero and the currents equal the vectors drawn from the vertices of the triangle to its center of gravity. The center of gravity is at the intersection of the lines drawn from the vertices to the midpoints of the opposite sides.

In the Figure 2 these currents are approximately 15 instead of 7, 29 instead of 36, and 23 instead of 21.

Waldo V. Lyon, Professor
Charles Kingsley, Jr. Asst. Professor
Massachusets Institute of Technology
Cambridge, Massachusetts.

To the Editor of ELECTRICAL WORLD:

Referring to the letter of Professors Lyon and Kingsley, which you called to my attention, I find that their analysis is correct and that my original article is not.

R. Philip Hart, President
Cazenovia (N.Y.) Electric Co.

•

Oxidation Inhibition

To the Editor of ELECTRICAL WORLD:

After preparation of the articles on "Oxidation Inhibitors in Insulating Oils" which appeared in February 17 and March 3, 1945, issues of ELECTRICAL WORLD, some additional laboratory data were obtained which may be of interest to your readers. The data are presented in Fig. 1 and Fig. 2 and show a striking difference in behavior between a conventional transformer oil and a particular inhibited oil. The tests were carried out at 125 deg. C. with copper catalyst in a modified Sligh test apparatus.

Fig. 1 shows that the conventional oil begins to absorb oxygen almost immediately and that the oxygen absorption is delayed for a considerable pe-

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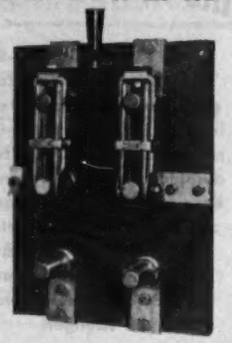
This switch is well suited to the tough going encountered in mine, railway, and industrial service. It's completely described in our catalog, a copy of which is yours for the asking.



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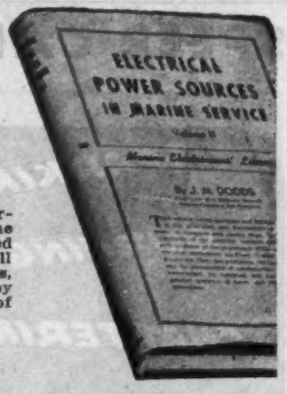
Principles, applications, data for... generation and distribution of power *in marine electricity*



This volume, second in the library of three books giving a thorough reference handbook treatment of every phase of marine electricity, covers all the material that a first class, fully qualified Marine Electrician should know about power generation. It will give ship and shipyard electricians—ashore and afloat—trainees, apprentices, ships engineering officers, etc., the essentials they need in the installation, testing, repairing, and maintenance of motors and generators of every kind.

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—the importance of "air gap"
—the relative advantages of a-c and d-c current on shore and on shipboard
—the problem of commutation and how it is secured under various loads
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riod in the case of the inhibited oil. However, once the inhibited oil begins to absorb oxygen, the rate of absorp-

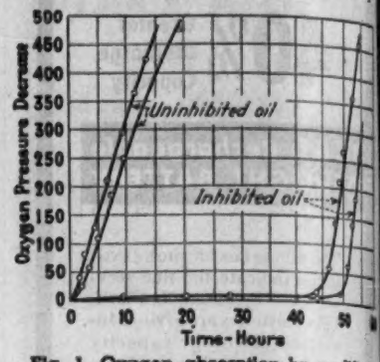
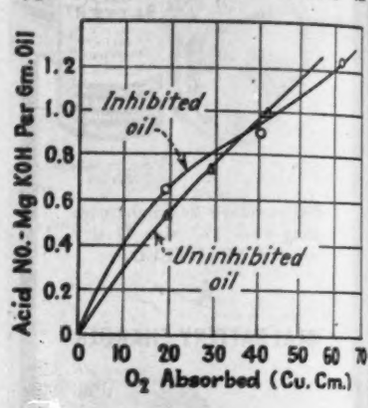


Fig. 1. Oxygen absorption by modified Sligh test at 125 C., copper catalyst (Mahncke)

tion appears to be approximately the same as for the conventional oil. Fig. 2 shows the relationship between the amounts of oxygen absorbed by the same two oils and the amounts of acid and sludge formed. It is to be noted that while the two oils show comparable acidities for a given amount of oxygen absorbed, the inhibited oil



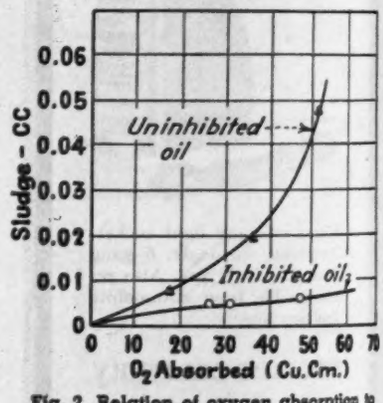
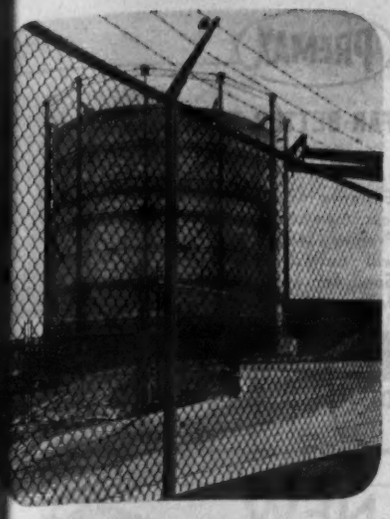


Fig. 2. Relation of oxygen absorption to acidity and sludge formation for inhibited and uninhibited oils

shows considerably less sludge than does the uninhibited oil for the same amount of oxygen absorbed.

This combination of delayed oxygen absorption and low rate of sluge formation when oxygen absorption occurs is very desirable, but is not neces-



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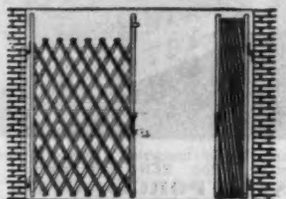

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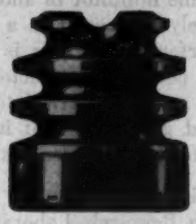

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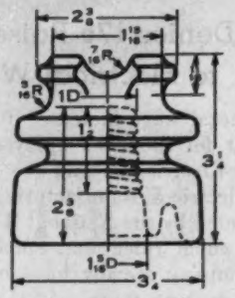

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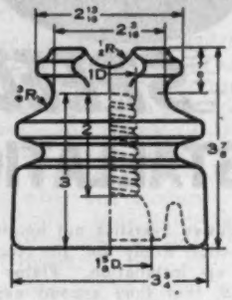

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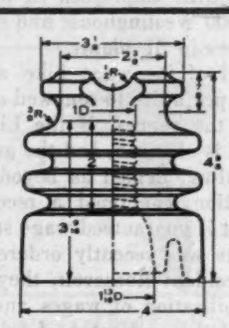

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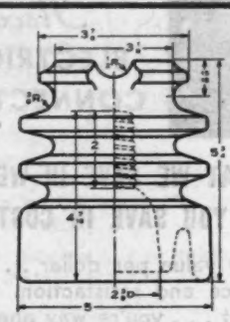
Std. Pkg. Carton	30



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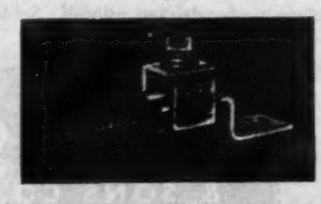

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sarily representative of all inhibited oils. The base stock and the refining procedure was chosen to obtain maximum effectiveness of the inhibitor. The use of the same inhibitor in another oil will very likely not result in a similar improved performance. This is one of the several complicated factors outlined in the articles referred to which has prevented general use of inhibited oils in transformers and cables.

L. J. Berberich
Westinghouse Research Laboratories
East Pittsburgh, Pa.

•

WLB Denies 17¢ Raise to Electrical Workers

A general wage increase of 17 cents per hour for 210,000 employees of the General Electric Co. and the Westinghouse Electric & Manufacturing Co. has been denied by the National War Labor Board, which ruled that employees of each company already have exhausted the 15 percent wage boost allowable under the Little Steel formula.

The board also denied requests that contracts contain an escalator clause providing a monthly bonus based on any increases in the cost of living since January 1, 1944, and for a guaranteed weekly wage. The requests were made by the United Electrical, Radio and Machine Workers, CIO, and covered 130,000 G.E. employees in 50 plants, and 80,000 Westinghouse and subsidiary employees in 31 plants.

Denial of the wage hike was made without prejudice to renewed consideration of the request if the Little Steel formula is changed, and the guaranteed wage ruling, denied as beyond NWLB jurisdiction, contained a recommendation that if guaranteed wage studies are made, as was recently ordered by the late President Roosevelt, they consider the stabilization of wages and production and the guarantee of full employment in the electric manufacturing industry.

•

Sylvania Plans to Open New Plant in Ohio

Expansion of manufacturing facilities for the production of electronic products will include a new plant at Marietta, Ohio, Sylvania Electric Products, Inc., has announced. The new 22,000 sq. ft. plant will be located in a five-story brick building recently leased from the Marietta Chair Co. W. H. Lamb will serve as plant manager and Edward Lewis will be resident general manager. Production is scheduled to begin at an early date.

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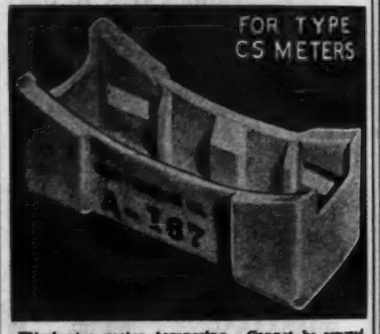

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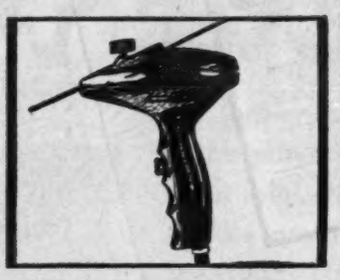
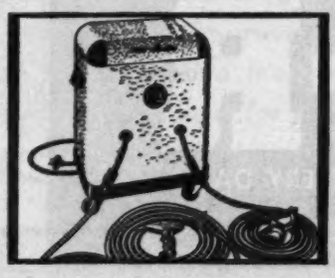
The Pencil Weld Gun, used with its Vibra-Weld Transformer, offers simplicity and versatility never before known in the industry. Equally effective in correcting flaws and defects in both ferrous and non-ferrous metals—for welding cold, without setting up stresses or crystallization.

Simple in operation, the Pencil Weld Gun requires but a few moments' practice to achieve results formerly unobtainable with any method. Utilizing a combination of air, high amperage and low voltage, the weld never exceeds 125° to 130° F. The gun uses a pure aluminum or nickel rod, which is applied directly to the defective area. When the surface has been finished and polished off, it is impossible to detect the repair. Easy to use, as gun peens and welds simultaneously. The Pencil Weld Gun and Vibra-Weld Transformer can be used wherever 220 volt single phase electricity and air outlets are available.

Unavailable, however, is Wrigley's Spearmint Gum. As the makers of Wrigley's Spearmint are unable to continue manufacture of the product up to their quality standards under present conditions, the only unqualified protection they can give to the consumer and the dealer alike is to keep the Wrigley's Spearmint wrapper empty. While they advertise this empty wrapper, none is being made and any found on the market is old production of a perishable product.



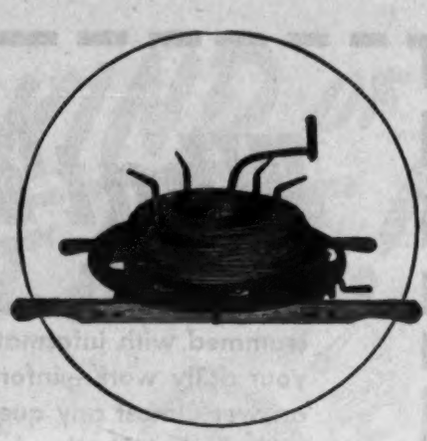
Close-up of new Pencil Weld Gun



Pencil Weld Gun with Vibra-Weld Transformer

You can get complete information from
Mid-States Equipment Company
2429 South Michigan Avenue, Chicago 16, Illinois

Z-68



Reel Facts.

You can pay $25.00 to $30.00 each year for cheap flimsy payout or take-up reels, but if you are interested in TIME COSTS you can pay $6.10 per annum for Matthews Adjustable Reels shown above and below, because they will last at least 10 years.

Here is what one customer wrote us in September, 1937, after they had had over 10 years' service from 50 Matthews Reels:—

"This will reply to your letter requesting our opinion of the Matthews Adjustable Reels now used by us in distribution work.

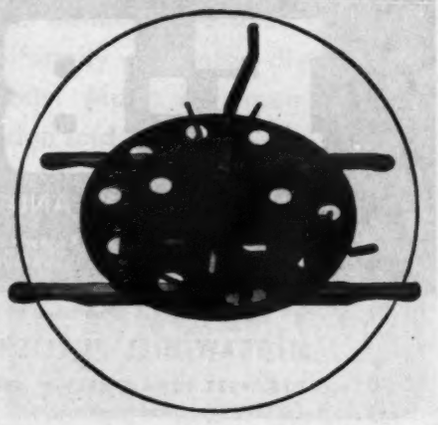
Our operating men have found this reel to have necessary sturdiness to withstand the general rough handling which is incident to this class of work, as well as the simplicity of design which permits ease of mounting or removing coils. The adjustable feature which holds coils tight when paying out wire is also regarded as a valuable adjunct.

In recent rural line extensions these adjustable reels were mounted on top of truck which moved along paying out wire on the ground. This method was used in order to reduce cost for this type of construction.

This covers in a general way our opinion of your reel. Hope this information will answer the questions you had in mind."

Use for paying out or taking up.
Send a trial order at our risk.

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.



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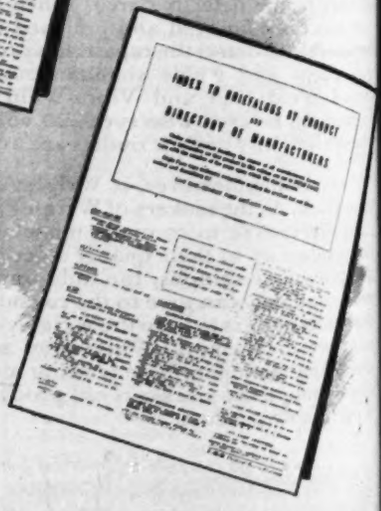

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BOOK REVIEWS

National Fire Codes, Vol. I, Flammable Liquids, Gases, Chemicals and Explosives. Published by National Fire Protection Association, Boston. 542 pages, illustrated. Price $3.

First of a series of compilation of codes, this one comprises standards, model ordinances and recommended good practices. Among some of the regulations of cognate interest to the electrical industry are those pertaining to fuel oil tanks, internal combustion engines, paint spraying, gas welding and cutting, refrigeration, explosives. Gasoline seepage incidents are described in detail. Extensive tables afford the hazards, storage and fire fighting of hazardous chemicals (25 pages) and the flash points, ignition temperatures, explosive limits, etc. of a large number of flammable liquids (50 pages). The book is an authoritative and comprehensive source of information about fire and life protection in this specific sphere.

Electric Traction for Cranes. By R. A. West. Published by Pitman Publishing Co., New York. 96 pages, illustrated. Price 15 shillings (net).

A quite practical discussion of motor characteristics for most effective hoist and travel performance of cranes is provided here by a British manufacturer's engineer. Analysis is referred to the basic elements of torque, speed, acceleration, friction and heating. Numerical examples and graphs afford generous and lucid support of the author's contention that the way to get the best productive output from cranes is not to skimp on the motors—acceleration is the issue for the comparatively short travels involved.

Introduction to Microwaves. By Simon Ramo. Published by McGraw-Hill Book Company, New York. 138 pages, illustrated. Price $1.75.

Ultrahigh frequencies and the associated microwaves are a mystery to electrical engineers who have lived mostly in a 60-cycle world. They need no longer be, because this book was conceived to translate the familiar concepts of low frequency phenomena by transitional reasoning into the megacycle behaviors. Without any mathematics whatever, the chapters discuss the progressive changes in skin effects, displacements, transit tunes, retardations and radiations. This leads to resonant cavities and wave guides by simple stages that constitute a distinctive and welcome bridge from power to radar and its kindred arts.

Plastics Catalog. Published by Plastics Catalogue Corp., New York. 1178 pages, illustrated. Price $6.00.

Measuring up to its secondary title "The 1945 Encyclopedia of Plastics", this technical-commercial assembly tells what one needs to know of plastics for any application. Fully half the space is devoted to the technology of creating, fabricating, processing and testing plastics.

It can serve as a reference handbook for the electrical engineer using plastic-insulated equipment because it embraces charts of identifying characteristics, curves and comprehensive tables of properties, solubilities, solvents, admixed plasticizers. There are charts of the chemical symbols and chemical origin of the various polymers, details of test procedures and specifications. Some of the newer things introduced in the current volume are silicones, impregnated woods, and organic coatings for metals. Throughout, there is care in including

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Keeps parts in easy reach and speeds up the job.

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electrical information along with that given molders, etc.

For the power sales engineer of the utility company there is extensive information about the processes (flow-chart) used in the fabrication and finishing of plastics, about the machinery used and about the controls customarily employed in the plant operations.

There is, of course, an authentic list of trade-names and of plastics producers.

Mechanical and Electrical Equipment for Buildings. By C. M. Gay and C. D. V. Fawcett. Published by John Wiley & Sons, New York. 453 pages, illustrated. Price $5.

Two University of Pennsylvania faculty men have provided in this second edition the basic principles and empirical data under-lying the water supply, plumbing and sewage and heating systems for buildings in terms of practical usefulness for managers and superintendents. More than half the book is, further, devoted to air conditioning, electrical systems, elevators and escalators, lighting and acoustics; these chapters, in particular, should afford utility power sales engineers with up-to-date occupancy, unit utilization and power-demand data for estimating service requirements and probable monthly consumptions. The book unquestionably teaches architects and engineers to talk the same language and have common aims in discussing the electrical needs of modern buildings.

Electrical Essentials in Marine Service. By John M. Dodds. Published by McGraw-Hill Book Co., New York. 419 pages, illustrated. Price $3.

This is the first of a three-volume electrical-marine series and persents the foundation knowledge of mathematics, physics and mechanics and electrical rudiments of generation and circuits (d.c. and a.c.). Power factor, watt-metering, transformer connections, wire and cable selection and installations are typical of the later contents. There is a final chapter on communication systems. Ensuing volumes will deal with (1) power sources and (2) power uses on board ship.

Industrial Electric Furnaces and Appliances. Vol. I. By V. Paschkis. Published by Interscience Publishers, Inc., New York. 232 pages, illustrated. Price $4.00.

Objective of the author is to provide the tooling of thermal analysis that will substitute rational mathematical design for much of the earlier empiricism. After a brief introduction to furnace fundamentals and practice the following topics are treated: temperature gradients and heat losses, criteria for shape of furnaces, avoidance of thermal short-circuits, power factor and skin effect. Other aspects treated analytically are optimum proportioning of electrode melting furnaces, choice of roof, doors and electrodes, calculation of busses, selection of controls and technique of performance analysis. Power sales and industrial electrical engineers, transformer and bus designers will find here the mathematical implementation of furnace design. A second volume is announced as covering induction, capacitance and resistance heating.

Delays Condemnation Vote

Omaha City Council has postponed from May 15 to June 26 the vote on a city ordinance to condemn the property of the Nebraska Power Co.

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ortfolio Contains Plans for Store Modernization

For electric appliance dealers and ility companies who wish to modern- their store rooms, Landers, Frary & lark have prepared a 40-page portfolio store planning which can be used in entirely or in part as a guide.

The portfolio, entitled "Moderneer- g," is based on three floor plans de- gned by Richard M. Bennett, professor design at Yale University. Topics vered in the book and prepared in operation with leading firms in their spective fields are store fronts, floor d wall coverings, fixtures, heating and ntilation, and inside and outside il- mination.

•

lew Plasticizer Imparts High Degree of Flexibility

A plasticizer which imparts a high egree of flexibility to vinyl coated fab- ics subjected to low temperatures uch as those used in strip coatings and sulation jackets has been announced y the Resinous Products & Chemical o., Philadelphia. Known as dioctyl ebacate, the material is a high boiling, table, light colored liquid and com- ines the low temperature flexibility as- ociated with dibutyl sebacate with the xtreme non-volatility characteristics xhibited by dibenzyl sebacate.

•

New Conservice Program

Westinghouse "Conservice" schools or 1945 will be expanded to include alf-day sessions on commercial re- rigeration and on the Westinghouse utomatic washer, the Laundromat, L. K. Baxter, manager of the service de- partment of the company's appliance division, Mansfield, Ohio, has an- nounced. Other features of this year's chools include a 30-minute, talking motion picture in full color, entitled, "It All Adds Up," which shows how good service builds good will and a sound slide film, also 30 minutes long, on "The Refrigerator Temperature Con- trol."

•

Opens New Branch Office

Graybar Electric Co., Inc. has opened a new branch office and fully stocked warehouse in Corpus Christi, Tex. Formerly the company maintained only a sales office in that city. R. E. Broyles has been appointed commercial man- ager in Corpus Christi with jurisdiction over the new branch office and ware- house.

•

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When you need Highest Quality at no extra cost insist on R&S throughout. Over 40 years of Design, Engineering and Construction experience is behind every R&S Product.

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LECTRICAL ENGINEER desires system operating position with electric utility. Age married, 2 children. Graduate with eleven ars utility experience including; appraisal, tribution engineering, system planning, sys-m and pool operating with hydro and steam ources. PW-861, Electrical World, 330 W. nd St., New York 18, N. Y.

LECTRICAL RELAY and meterman—22 ears experience, relays, watthour meters, ltage regulators, automatic switching equip-ent. Location preferred South. PW-869, ectrical World, 520 N. Michigan Ave., Chicago , Ill.

E. GRADUATE, age 41, married, veteran this war. Majority of past twenty years in super-sory capacities in private and government wer operations. Background includes distri-tion and transmission design, construction, d operations; hydraulics and area investiga-ons; industrial design and application; sales d public relations; and area management and pervision. Will consider sales or engineering sition, with post-war opportunity. PW-871, ectrical World, 330 W. 42nd St., New York 18, Y.

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STABLISHED REPRESENTATION for sale of materials to utilities in Middle West is fered. Please advise products and coverage ired. RA-862, Electrical World, 520 N. Mich-an Ave., Chicago 11, Ill.

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WANTED

SALES ENGINEERS

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WESTINGHOUSE
Electric & Manufacturing Co.

WANTED

By a centrally located electric light and power company

Men to fill postwar positions in our Sales Organization. We need:

Assistants to
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Supervisors

Plus Several Top Notch Salesmen, Including

Men Who Can Specialize in Selling:
Commercial Cooking
Air Conditioning
Industrial Heating

Age limit 25 to 40. College training desirable. In first letter give complete information about training, experience, names of former employers, how long employed by each, who to write for reference, age, number of dependents, salary expected, how soon available. Send picture.

SW-843, Electrical World
520 North Michigan Ave., Chicago 11, Ill.

Assistant to Sales Manager

Excellent opportunity as assistant to sales manager well established electrical manufacturer located Eastern States. Electrical engineering graduate with five to ten years experience in direct selling to industry and knowledge of sales promotion. Our organization knows of this advertisement.

SW-870, Electrical World
330 West 42nd St., New York 18, N. Y.

UNUSUAL OPPORTUNITY FOR FIELD ENGINEER

Prominent midwestern manufacturer of electrical distribution equipment has a place on the field staff for a young, alert, aggressive electrical engineer.

This man should be familiar with electric transmission and distribution practice.

Good starting salary and excellent opportunity for advancement. Write at once giving complete details of education and past experience. Personal interview will be arranged.

P-857, Electrical World
520 North Michigan Ave., Chicago 11, Ill.

WANTED

RESEARCH ENGINEER

Leading manufacturer of power distribution equipment needs a research and development engineer. Position is permanent and located in Middle West.

Requirements are for a man who is naturally ingenious and creative in his ideas. He should enjoy engineering investigative and design work. He should have the enthusiasm and initiative to operate under his own steam. The position will permit him to develop to the full extent of his abilities.

If you feel that you are fitted for this position, and are not now employed in a full-time war job, please write a letter outlining your education, experience, and other qualifications.

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D C MOTORS

	HP	Make	Type	Volts	Speed
2—	1250	G.E.	MPC	550	160
1—	1200	Whse.	Compen.	550	600/720
1—	800	G.E.	MPC	660	600
1—	700	G.E.	MPC	250	200/360
2—	625	G.E.	MPC	500	160
1—	600	G.E.	MPC	600	650/900
1—	500	G.E.	MPC	230	900
1—	500	Whse.	Compen.	250	800/720
1—	350	G.E.	MPC	220	450
1—	300	G.E.	MPC	230	275/550
1—	250	Al. Ch.		230	525
2—	200	Whse.		230	400
1—	175	Whse.	SK	240	150/525
1—	150	G.E.	MPC	230	250/450
2—	130	Cr. Wh.	CMC-65H	550	1200
2—	125	G.E.	CO-	230	625
1—	100	G.E.	LC-50	230	1200
1—	100	G.E.	MPC	230	225/450
1—	100	G.E.	RC-38	230	600
1—	75/100	Whse.	SK-183	230	450/900
1—	75	G.E.	LC	230	500/1000
2—	75	Whse.	SK-183	230	560/1100
1—	60	Al. Ch.	E-131	115	1750
1—	60	El. Dy.	258	230	424/1050
2—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	Cr. Wh.	CMC-81H	230	300/900
1—	50	G.E.	RC-19	230	400/1200
2—	40	El. Dy.	308	230	300/900

TRANSFORMERS

KVA		Make	PH	Type	Voltage
2—	1667	Pitts	1	OISC	13200x2300
1—	1050	G.E.	3	WCTH	11000x445
4—	525	G.E.	1	HJDD	2300x445
4—	500	Pitts.	1	OISC	13200x2300
3—	333	Moloney	1	C-OISC	22000/11000x2300/575
2—	333	Whse.	1	OISC	2300x460
2—	333	Pitts.	1	OISC	2400x220
3—	300	G.E.	1	H-RP	13200x575/1150/2300
1—	300	Pitts.	3	ODSC	4150x208/120
3—	200	G.E.	1	H-IDD	6400x115/460

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP 2300 V.
1—1000 KW G.E. 250 V. DC to 1400 HP 2300 V.
1—1000 KW Whse. 600 V. Gen. d.c. to 2000 Kva—2200 V.
1—750 KW Whse. 275 V. Gen. d.c. to 1100 HP 2300 V.
1—750 KW G.E. 250 V. Gen. d.c. to 1080 HP 2300/4150 V.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW GE 250/275 V. Gen. d.c. to 650 HP 2300 V.
1—350 KW GE 220 V. AC Gen. d.c. to 500 HP 250 V. DC motor.
1—200 KW GE 125 V. Gen DC to 300 HP—440 V.
1—150 KW Ideal 3 unit with 250 HP. 440 V. Syn. motor and 2—75 KW. 125 V. generators.
1—75 KW GE 125 V. Gen to 120 HP IK 400/2300.
1—50 KW GE 125 V. Gen. to 75 HP KT 4000/2300 V.

TURBO GENERATOR SET

1—500 KW. Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 Cycle

	KW	Make	Speed	D.C. Volt	Trans. Volts
1—	1500	Whse.	720	600	2300
1—	1500	Whse.	600	600	11500
1—	1250	G.E.	720	250	2300
1—	1000	G.E.	900	600	13200
1—	1000	Whse.	900	600	11000
1—	750	G.E.	1200	600	2300
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300
1—	300	Al. Ch.	1200	250	2300
2—	300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts
2—	2100	G.E.	ATI	2300/4600
1—	600	Al. Ch.		2200
2—	200	G.E.	TS-7644	2300
1—	75	G.E.	TS-7556	220/440

Slip Ring

1—	1200	Cr.-Wh.	801-Q	220
1—	800	Al. Ch.		440
1—	600	G.E.	MT	550
1—	600	Cr. Wh.	131-AQ	2300
1—	500	Al. Ch.	ANY-36	2300
1—	450	Whse.	CW	2200
1—	400	Al. Ch.		2300
1—	400	G.E.	IP	2200
1—	350	G.E.	MT-442y	550
1—	250	G.E.	MT	4000/2300
2—	250	Whse.	CW	2300
1—	100	G.E.	IM	220
1—	100	G.E.	IM	2200

Squirrel Cage

1—	300	Whse.	CS	550
1—	300	G.E.	IK-17	440
1—	200	G.E.	IK	550
1—	175/112	G.E.	IK	440
1—	150	Whse.	CS	550
1—	100	Whse.	CS	2200

SYNCHRONOUS CONDENSERS

1—	5000	Whse.		2300/4
1—	3000	Al. Ch.		2300
1—	2000	G.E.	ATI	600
1—	2000	Whse.		2400
1—	1000	G.E.	ATI	200/3800
1—	750	G.E.	ATI	220/440

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MOTOR GENERATOR SETS

75 KW, 125 volt, General Electric, squirrel cage.
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6½ KW, 125 volt General Electric, squirrel cage.

MOTORS—3 PHASE 60 CYCLE

500 H.P., 900 RPM, 440 volt, Lincoln slip ring.
400 H.P., 220 volt, 1200 RPM, Westinghouse squirrel cage.
350 H.P., 300 RPM, 400 volt, General Electric slip ring.
250 H.P., 600 RPM, 2200 volt, General Electric slip ring.
200 H.P., 1800 RPM, 220 volt, General Electric slip ring.
200 H.P., 600 RPM, 550 volt, Westinghouse slip ring.
200 H.P., 600 RPM, 440 volt, Crocker-Wheeler slip ring.
150 H.P., 1800 RPM, 440 volt, General Electric squirrel cage.
150 H.P., 1800 RPM, 220 volt, Westinghouse slip ring.
150 H.P., 400 RPM, 440 volt, General Electric squirrel cage.
100 H.P., 720 RPM, 440 volt, General Electric slip ring.
100 H.P., 600 RPM, 2200 volt, General Electric slip ring.
100 H.P., 450 RPM, 440 volt, General Electric squirrel cage.
100 H.P. 1800 R.P.M., 440 volt, G. E. squirrel cage.
85 H.P. 900 R.P.M., 220 volt, G. E. synchronous.
75 H.P. 900 R.P.M., 220 volt, G. E. slipring.

Gasoline Driven Generator Sets

2—25 KW, 125 volt, direct current
130 KW, 125 volt, direct current

1— 90 H.P., 400 RPM, 650 volt, Crocker-Wheeler squirrel cage.
1— 75 H. P., 900 RPM, 4000 volt, Electric Machinery synchronous.
1— 75 H.P., 720 RPM, 440 volt, Westinghouse slip ring.
1— 60 H.P., 1200 RPM, 440 volt, General Electric slip ring.
1— 50 H.P. 1200 R.P.M. General Electric, Squirrel Cage.
1— 50 H.P., 900 RPM, 440 volt, General Electric slip ring.

MOTORS—D.C. 230 VOLTS

2—450 HP, 400 RPM, G.E.
1—250 HP, 760 RPM, Electro Dynamic
2—125 H.P. 950 R.P.M. G.E.
1—100 HP, G.E., 575 RPM.
1— 50 HP, 750 RPM, Westinghouse, type SK.
1— 50 HP, 700 RPM, Crocker-Wheeler.
1— 40 HP, 775 RPM, Westinghouse.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
2—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E., 32,000 2300/4000 Y.
2—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-130/208Y.
2—50 KVA, Phgh., 7500/15,000 volts-110/220 volts.
3—50 KVA, Pittsburgh, 2200-220/110.
3—37½ KVA, General Electric, 2200/220/440
1—25 KVA, G.E., 220/110-20/110 volts.
2—25 K.V.A. G. E. 2200—220/110.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—35 HP, 500/1500 RPM, Westinghouse.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
2—25 HP, 300/990 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 500/1200 RPM, G.E.
1—12/18 HP, 250/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type, SK.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

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25—Westinghouse type U recording voltmeters.

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1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

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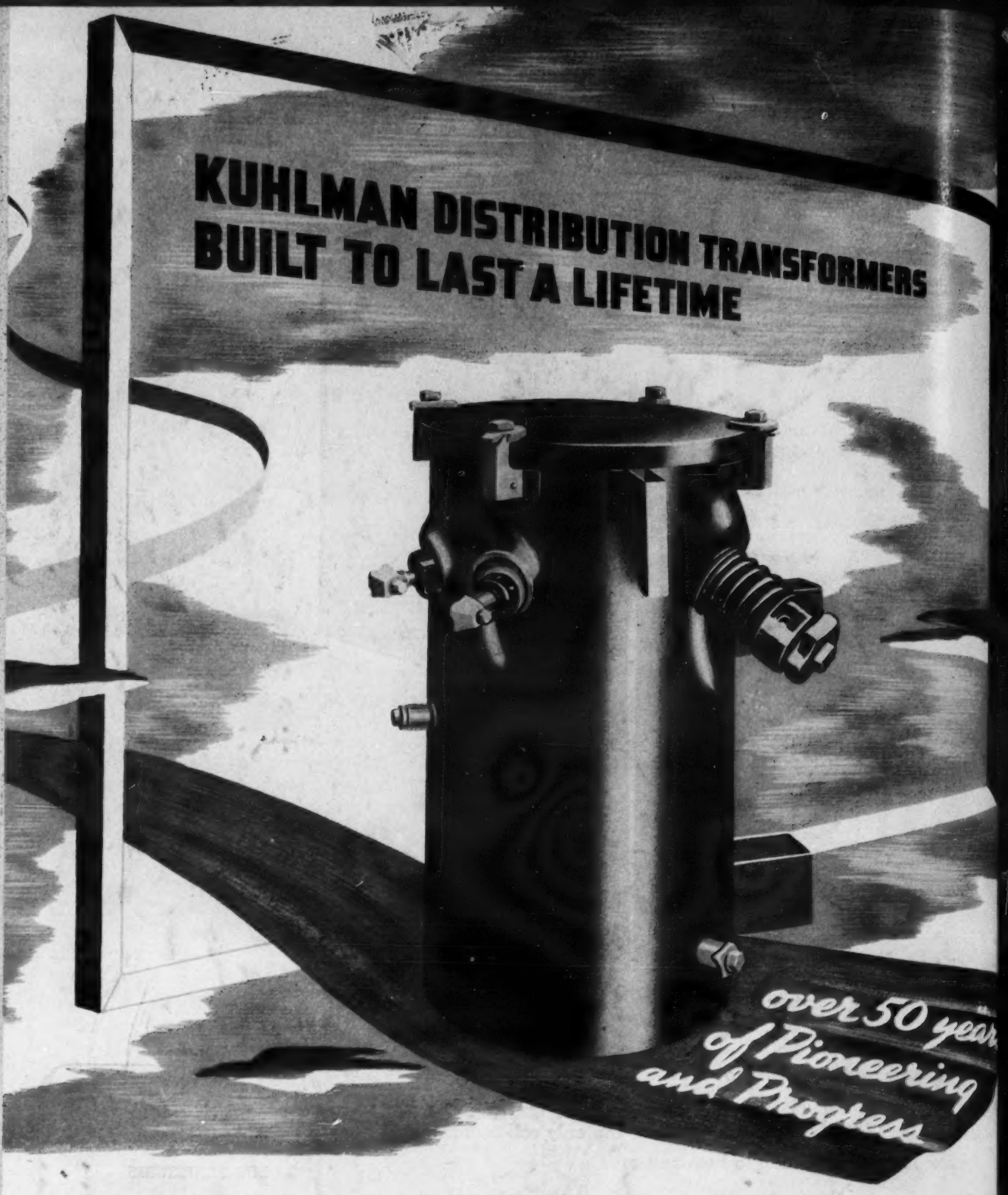

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